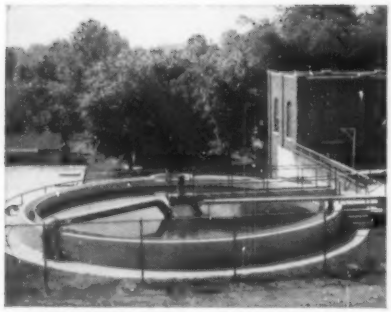
PUBLIC WORKS

June 1957

CITY, COUNTY AND STATE

James W. Spencer, Highway Research and Extension Engineer (Associate Professor), Cornell University, conferring with a soils student. He is chairman of the annual School for Highway Supts. See p. 24.

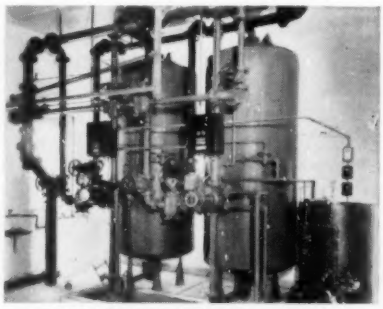


TURBIDITY gets cut from 1500 to less than 5 ppm in this Precipitator. Mt. Carmel, Ill. Cons. Eng.: *Warren & Van Praag, Inc.*

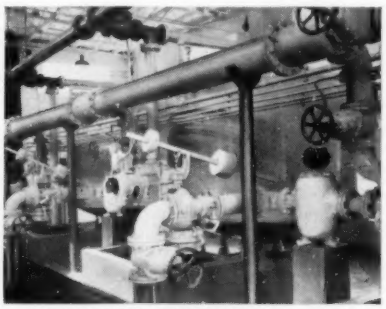
SEA WATER saves $32,980 per year over salt for regenerating Softeners. Hollywood, Fla. Cons. Eng.: *Reynolds, Smith & Hills.*

30 PPM IRON gets cut to 0.14 ppm in Aerator and Precipitator . . . even before filtration! Fairless Hills, Pa. Cons. Eng.: *H. H. Le Van, Jr.*

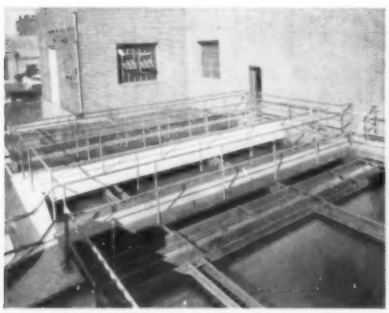
HARDNESS TESTER starts regeneration of softeners automatically, saves manpower. E. Aurora, N. Y. Village Eng.: *E. J. Maurer.*



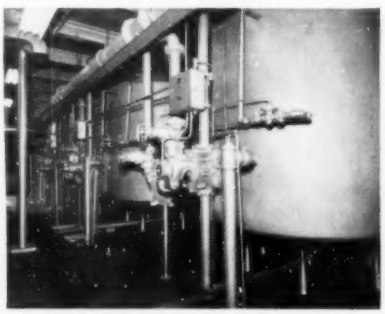
269 PPM HARDNESS is removed by these automatic Softeners. Aerator and Filters cut iron. Martinsville, Ill. Supt.: *O. Wiser.*



AUTOMATIC CONTROLS backwash, regenerate, rinse and return Softeners to service. New Smyrna Beach, Fla. Cons. Eng.: *Russell & Axon.*



OLD SETTLING BASINS house these modern Precipitators that boost capacity. North Kansas City, Mo. Cons. Eng.: *C. A. Haskins.*



SOFTENER CAPACITY TRIPLED and $7,000 yearly saved on salt by change to Permutit Q resin. Normal, Ill. Cons. Eng.: *Farnsworth & Conley.*

TRIPLE TROUBLE! 275 ppm hardness, 200 ppm alkalinity, 3 ppm iron are reduced by this Precipitator. Staples, Minn. Supt.: *E. H. Klang.*

Why these cities chose **PERMUTIT®** *water conditioning*

Some chose Permutit for its world-known engineering experience gained through thousands of installations covering every major development in clarification, filtration and softening equipment.

Others chose Permutit to get complete, integrated service: the water-analysis labs, engineering, equipment, controls, ion exchange resins—all from one source, under one responsibility.

But most of the designers of these plants chose Permutit because they have personal knowledge of many installations where Permutit equipment has given long years of efficient, trouble-free performance. They know that's what pays off in the long run.

Write for Technical Bulletins. The Permutit Company, Dept. PW-6, 330 West 42nd St., New York 36, N. Y.

SOFTENERS • ZEOLITES and RESINS • AUTOMATIC CONTROLS • GRAVITY FILTERS • PRESSURE FILTERS • PRECIPITATORS • CHEMICAL FEEDERS AERATORS • SWIMMING POOL SYSTEMS • IRON REMOVAL EQUIPMENT

THE NO. 212—EVERYTHING ONE CITY NEEDS

The City of Glendale, Arizona, is proud of its streets and the way they're kept up. There's all the usual work for a motor grader—sidewalks, streets, curbs, cutting and cleaning gutters, leveling land, blacktopping. And the city does it all with just one machine—a CAT* No. 212 Motor Grader.

In one 8-hour day the No. 212 shown above has mixed and spread up to 350 tons of asphalt. The operator says: "I like the way it handles in narrow streets and on small jobs where you have to get around. It's got plenty of power for bigger jobs, too."

The way to choose a motor grader is by the *work it will do*. You don't buy it to brag about its size or what it cost. The No. 212 is the smallest and lowest-priced grader in the Caterpillar line. But it has proved that by taking a little more time it can do just about anything larger motor graders can.

Its 50 HP Caterpillar Engine is tough, simple, dependable, and it burns low-cost fuels such as No. 2 furnace oil without fouling. The whole machine is ruggedly built to stand up to steady work. It's easy to operate, with positive-acting power controls. No need to stand up to see the wheels, the blade and the job you're doing. And there's a full range of blade positions that can be changed from ditching to bank-sloping in less than a minute without leaving the seat.

Low first cost, low operating costs and high trade-in value make the No. 212 the right machine for many communities. Ask your Caterpillar Dealer for a demonstration on your own job. You can count on his reliable parts and service to protect your taxpayers' investment.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

**NAME THE DATE...
YOUR DEALER
WILL DEMONSTRATE**

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PUBLIC WORKS DIGESTS

DEPARTMENTS AND SECTIONS

BPA

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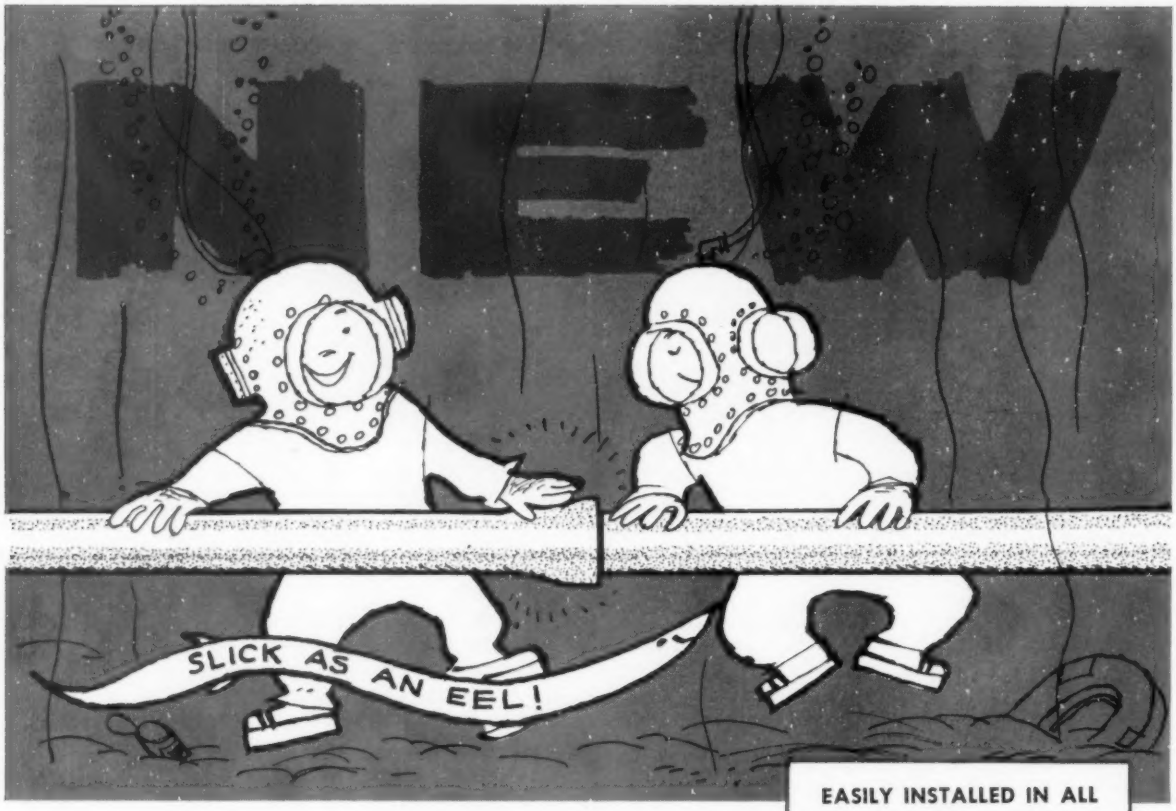
Established 1896

Published Monthly by Public Works Journal Corporation. Office of Publication at Orange, Conn. Editorial and Advertising offices at 200 So. Broad St., Ridgewood, New Jersey. Subscription rates: U.S.A. and possessions, $5.00. Canada and South America, $6.00. All other countries, $7.00. Accepted as controlled circulation publication at Orange, Conn.

JUNE 1957

PUBLIC WORKS

Vol. 88, No. 6



EASILY INSTALLED IN ALL KINDS OF WEATHER . . . YOU COULD EVEN DO IT UNDER WATER!

CLOW

SLIP-ON PIPE JOINT*

forms bottle-tight joint instantly!

Saves you so much time you'll think the clock is paralyzed. Yet assembly is simple and easy, and you get a seal that's tight as a drum. Best of all, you get Clow Cast Iron Pipe . . . for the watermain installation that is economical and permanent.

Want more details? You should have them. There's a Clow man not too far from you right now . . . ready to give you all the facts. Phone us—or drop us a note.

**Patent applied for*

EASY AS "A-B-C"!

A INSERT GASKET IN BELL.

B WIPE ON LUBRICANT.

C SLIP PLAIN END INTO BELL.

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Iowa Valve Company, Oskaloosa, Iowa

POINT OF VIEW

Sanitary Engineering Certification Deadline is Extended

THE STATUS OF THE sanitary engineering certification program by the American Sanitary Engineering Intersociety Board was mentioned on this page in our March issue. Many requests for information were received and forwarded. Since the appearance of that note, the time for certification without examination has been extended to October 1 of this year. However, application forms should be requested before that time. Those who are eligible (a degree and fifteen years of satisfactory experience) should write directly to the Secretary of the Board at 33 West 39th St., New York, New York.

Consulting Engineers are Needed for the Interstate Highway Program

EXPANDING AN ENGINEERING department two or three-fold is not easy, even in times when engineers are available. In these days when the demands for engineers exceed the supply, it may be just about impossible. Fortunately we have the skills and organizations developed by our consulting engineers and these are available for much of the work needed to get the Interstate Highway program started promptly and carried on efficiently. The states have the first big job to do; some will have an engineering organization capable of handling the program; many will not. For these latter and for the cities and counties, which will also have many problems in this connection a little later, the established consulting engineers can be the difference between success and failure in attaining the objectives of the highway program.

Emergencies Have a Way of Creeping Up On Us

NOW THAT THE SAFETY factors originally built into our public works have been pretty largely used up by the growth of population and through other factors, we can expect emergencies to develop. The most common ones, or rather the ones we note most quickly, are probably water shortages and traffic congestion, but others come along, too. Too often these emergencies are quite unexpected; but they ought not to be. Someone ought to be responsible for anticipating them and for giving warning of their approach, backing up the warning with engineering data.

Doing this is a challenge to our engineers and technical men. It is not necessary to be a seer, or even a seventh son of a seventh son. What is needed is a system which will provide data indicative of trends, whether in traffic flows, water consumption, refuse disposal, sewage or industrial waste treatment. Past records are, in many cases, our best guide to the future but they need to be well mixed with sound engineering judgment.

Savings by Using Modern Refuse Collectors

THE POTENTIAL SAVINGS resulting from using modern refuse collection vehicles are often astonishing; a saving of one-third over open vehicles is a conservative guess. This comes primarily from the greatly increased capacity resulting from compaction with consequent fewer trips to the disposal area. Travel from the end of the collection route to the landfill or incinerator and back again to the starting point for a new trip is dead time so far as making money is concerned. The less of such dead time there is, the lower the cost of collection.

Another saving not so generally realized is the saving in garage or parking space needed to house and service the necessary number of units. Comparing such needs for modern large-capacity units with requirements for open trucks, or even for older smaller-capacity compacting units may reveal some startling savings.

A Once-a-Month Job for Every Engineer

THERE IS PERHAPS no time that could be better spent by any engineer than that required to leaf through the advertising pages of at least one good engineering magazine every month. In no other way can one become so promptly acquainted with the many devices now available by which better and cheaper public works can be provided quickly and at lower cost.

The days of doing things merely by man power are recognized as having passed; but too many cities, counties and states are still relying on outmoded and even dilapidated equipment. Inefficiency in operation, excessive maintenance and lost time due to breakdowns can cost far more than a new machine.

There are more cars on the road, more water being used, more refuse to collect and dispose of—and a different kind—and more liquid waste to treat. Progress does not wait for work to be accomplished by yesterday's tools. Mostly we are paying for modern equipment whether we have it or not.

whatever the problem . . .

Two things you're sure of when you use cast iron pipe. It will do the job. It will last.

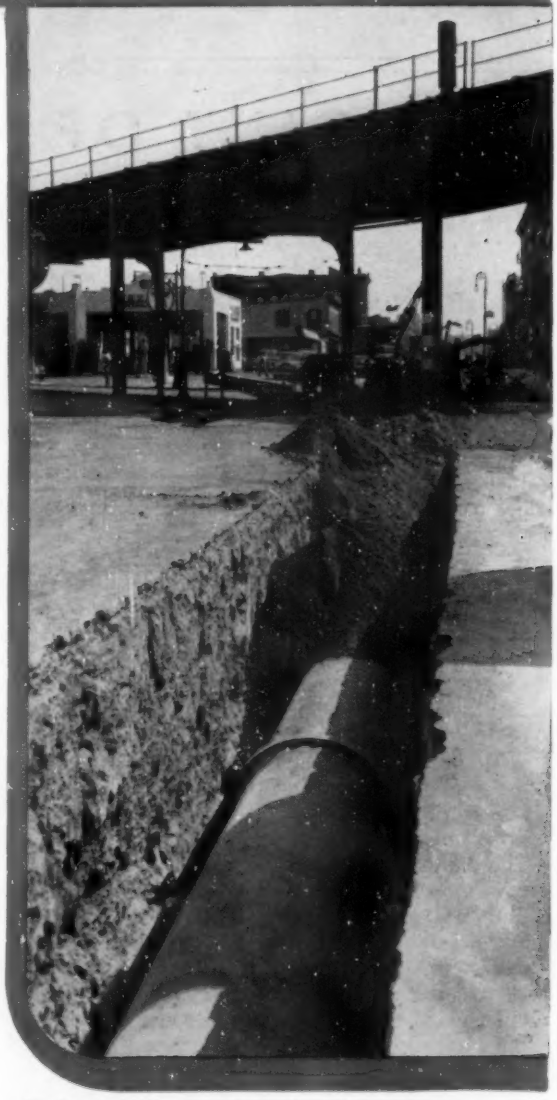
Proved in *water* service . . . for fire protection, feeder and distribution mains, purification plants.

Proved in *gas* service . . . for feeder and distribution mains.

Proved in *sewerage* systems . . . for force mains, outfalls, treatment plants.

Engineers everywhere are familiar with cast iron pipe's outstanding record. They specify it because it's versatile . . . because its rugged strength has served for centuries. And, today, *modernized* cast iron pipe, centrifugally cast, is even stronger, more durable.

For information, write: Cast Iron Pipe Research Association, Thomas F. Wolfe, Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Illinois.



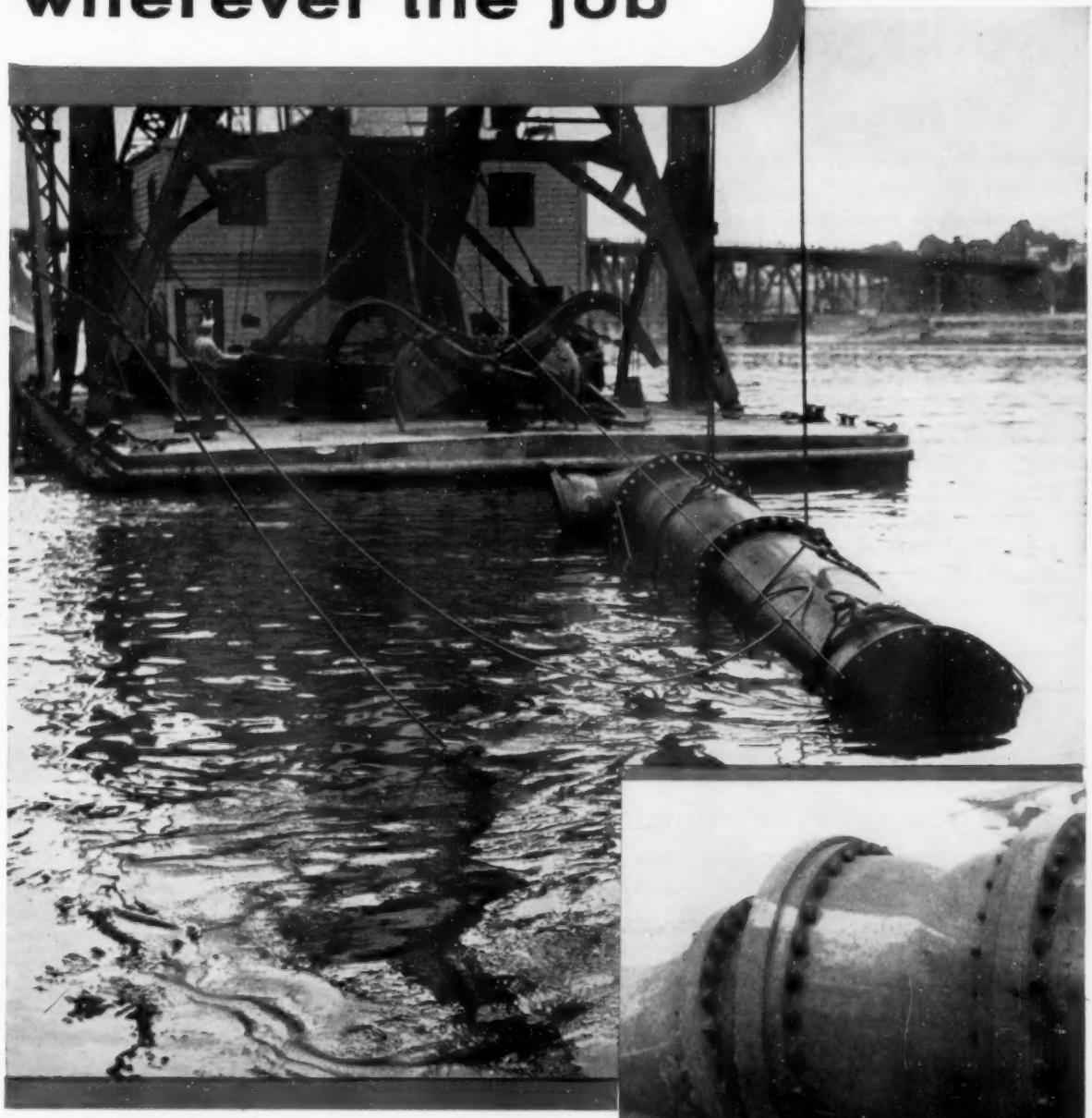
Brooklyn, N. Y.—Laying 42" Mechanical Joint cast iron pipe for gas main.

CAST IRON

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Ill.

CAST IRON PIPE

wherever the job



Portland, Ore.—Large diameter cast iron sewer lines being installed across Willamette River, part of program to restore normal river conditions for salmon spawning.

St. Louis County, Mo.—36" cast iron intake line at the North County Water Plant of the St. Louis County Water Company.

SERVES FOR CENTURIES...

Simplify and save on public works electrical construction . . .

How can you simplify electrical details of a public works project?

By planning an electrical system around the one product line that includes *everything* electrical . . . each product made with the other in mind. That's Westinghouse.

This means perfect integration, freedom from costly fitting on the job. It means elimination of extras and misfits. It results in a finished job that is sound, snug and simple compared to any assembly of miscellaneous brands and qualities.

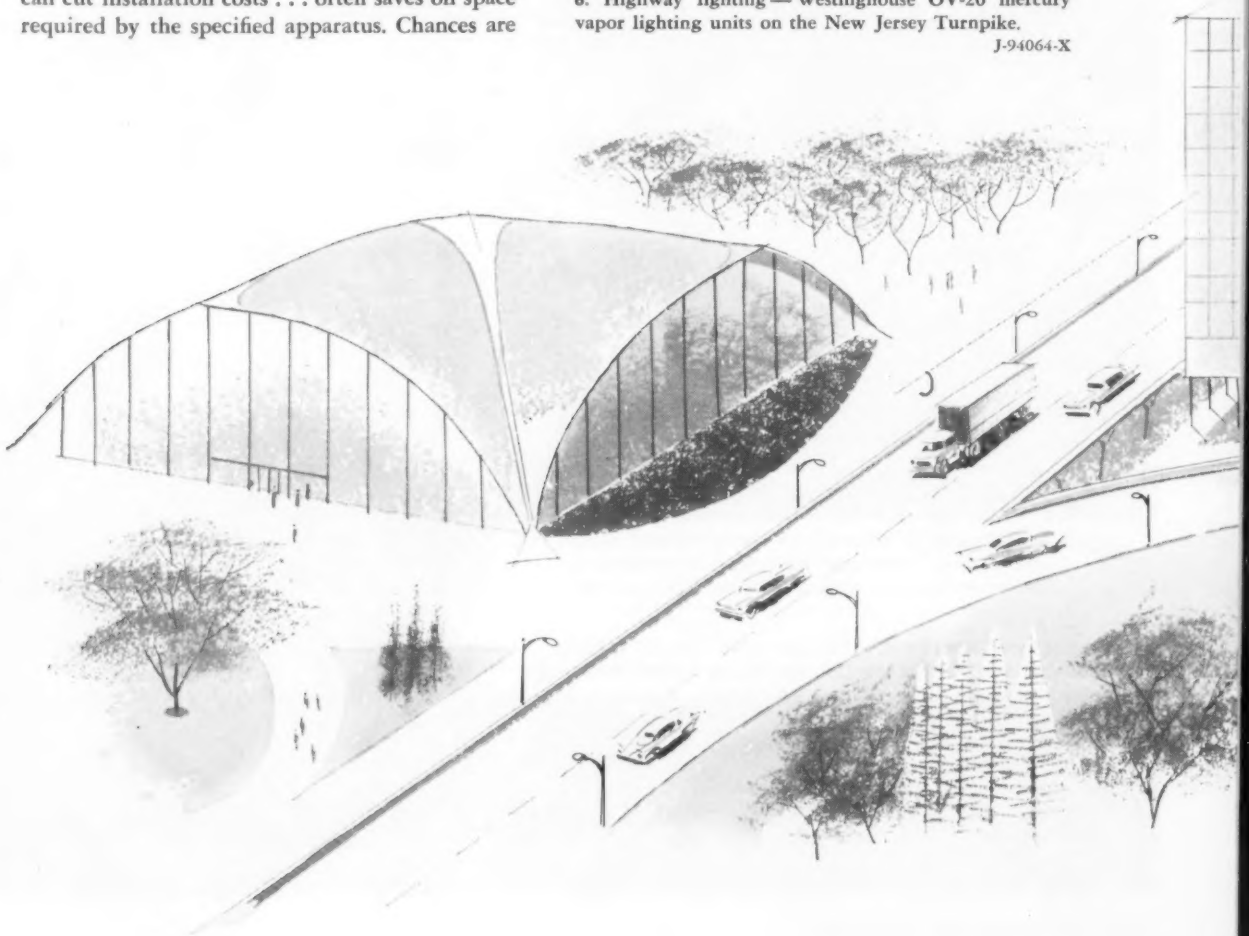
How can you save on such a job?

By using the services of Westinghouse field specialists in planning a system precisely to fit the need. This teamwork approach to the job can mean savings in planning time. Skillful application of the broad Westinghouse product design can cut installation costs . . . often saves on space required by the specified apparatus. Chances are that one of the biggest savings will be most apparent in later years as the expertly planned system proves its adaptability to growth in any direction.

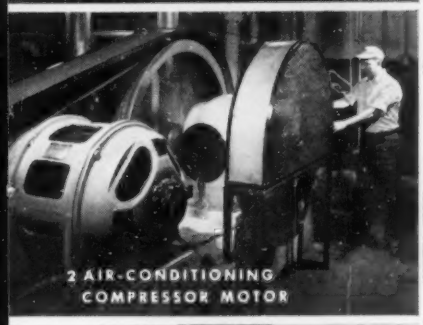
There's a Westinghouse electrical construction specialist as near as your telephone. Call him. He can demonstrate how to simplify and save on your next public works job. Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

1. More than 100 motor drives are controlled at the City of Houston Water Works by this Westinghouse control center 2. Heavy-duty Westinghouse motor driving air compressor unit. 3. Motor driving freight elevator at the City of Cincinnati Little Miami Sewage Treatment plant. 4. Low-voltage drawout switchgear in municipal building protects branch circuits and equipment with Westinghouse De-ion® circuit breakers. 5. City of Houston Water Works carries high-voltage power close to load areas with Westinghouse totally-enclosed power centers. 6. Highway lighting — Westinghouse OV-20 mercury vapor lighting units on the New Jersey Turnpike.

J-94064-X



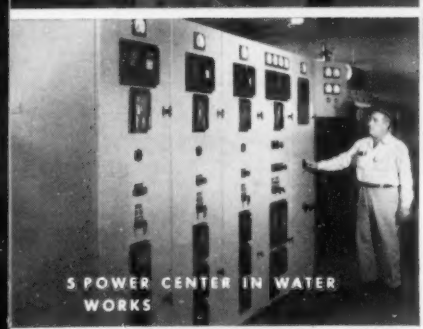
1 WATER SYSTEM CONTROL CENTER



2 AIR-CONDITIONING COMPRESSOR MOTOR

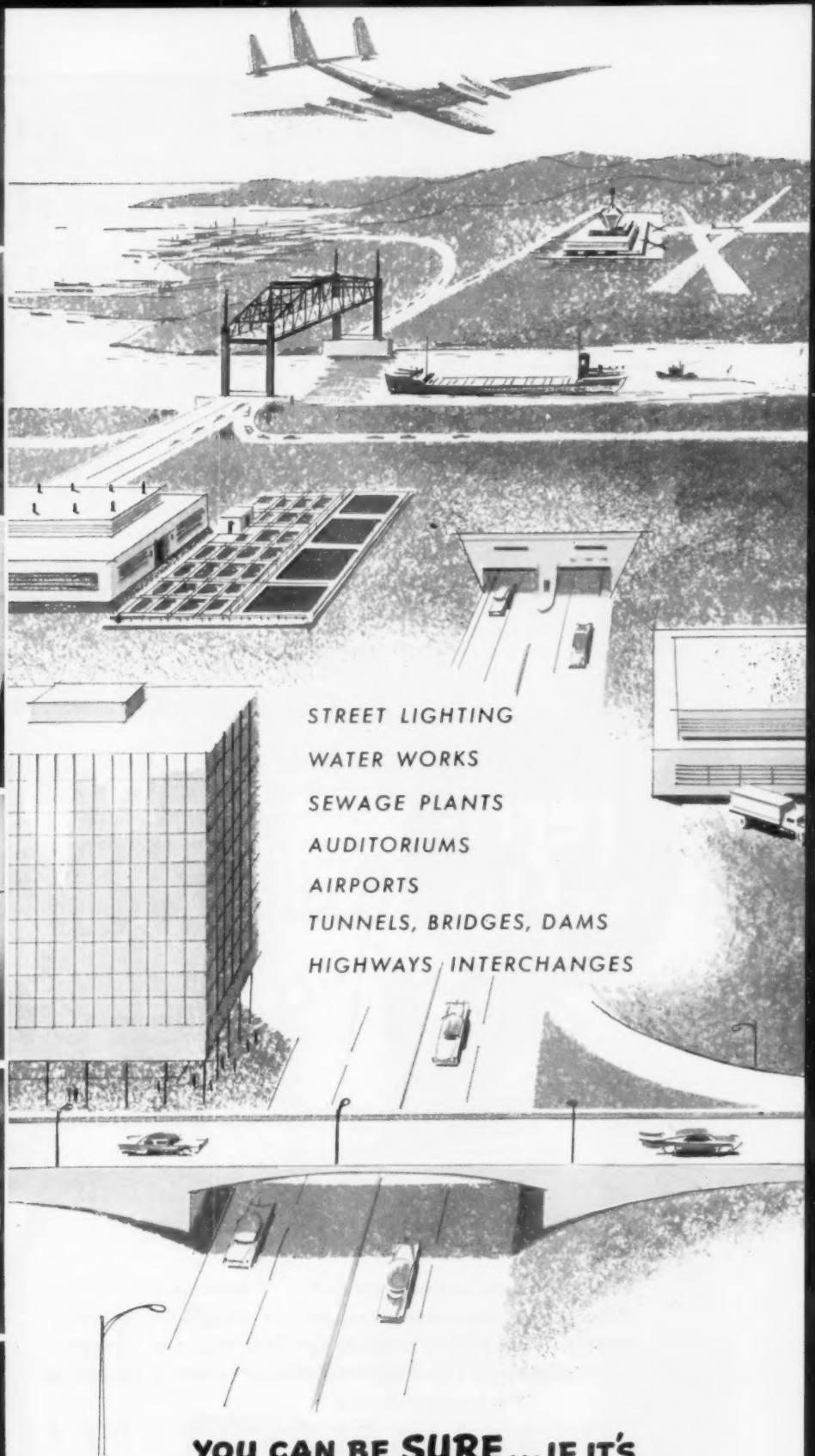
3 MOTOR DRIVE IN SEWAGE PLANT

4 MUNICIPAL BUILDING SWITCHGEAR



5 POWER CENTER IN WATER WORKS

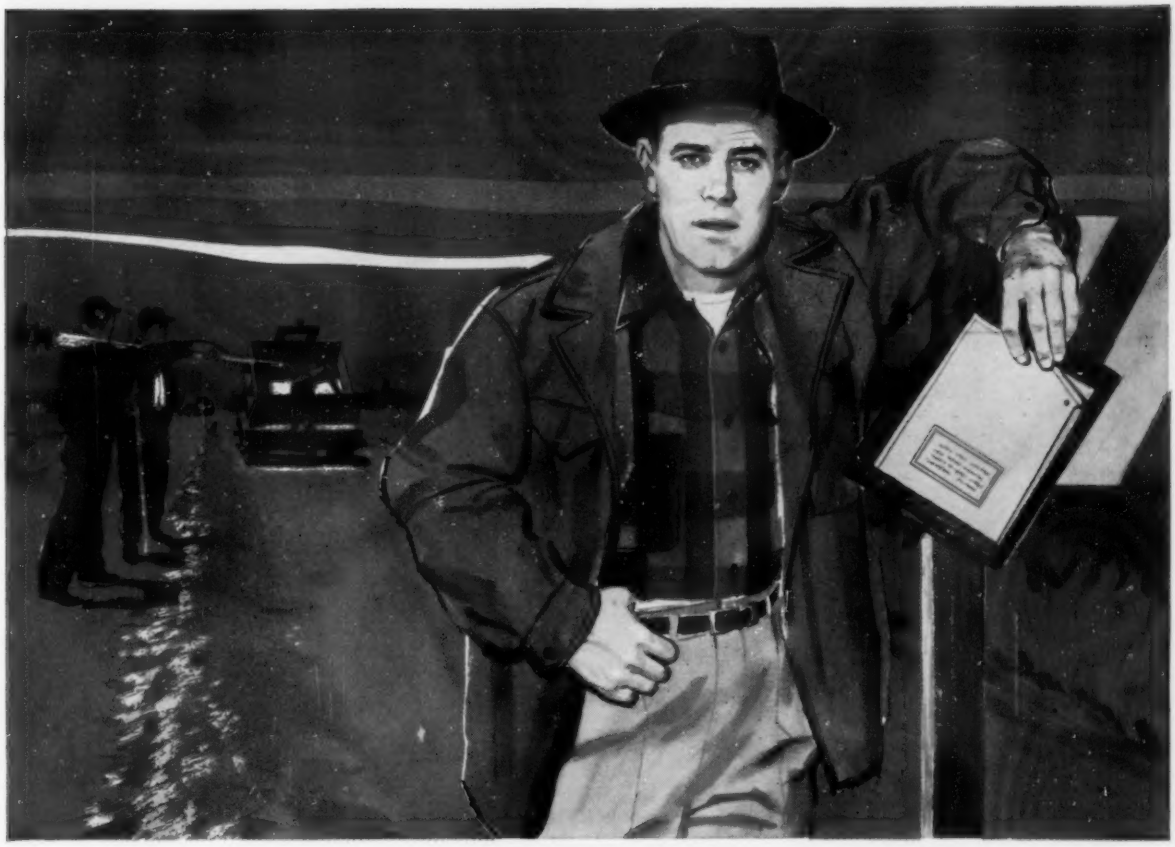
6 HIGHWAY LIGHTING



STREET LIGHTING
WATER WORKS
SEWAGE PLANTS
AUDITORIUMS
AIRPORTS
TUNNELS, BRIDGES, DAMS
HIGHWAYS, INTERCHANGES

YOU CAN BE SURE... IF IT'S

Westinghouse



Salt stabilization builds better roads

Stabilizing with *Morton* Salt means added road life and reduced maintenance costs.

Stabilizing a road with Morton Salt is often the difference between a good road that will stand up under heavy traffic and a road that will require excessive maintenance within a year.

Secondary roads. Regardless of the materials used, roads stabilized with Morton Salt give more service per dollar than roads built by any other method—and the savings in aggregate alone more than pay for the salt. You get smooth, durable, water-repellent surfaces that require minimum maintenance.

Primary roads. Stabilizing the base course with Morton Salt helps prevent the 9 out of 10 road failures which result from faulty foundations.

Shoulders. Stabilizing shoulders with Morton Salt not only checks erosion and rutting, it reduces dust and eliminates accidents caused by soft shoulders . . . also saves on grass and weed removal.

☐ ***Please send me your free booklet on salt stabilized roads.***

☐ ***I also would like free technical assistance from a Morton Road Building Engineer.***

Name_____
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Title_____

Address_____

City_____ County_____ State_____

MORTON SALT COMPANY

INDUSTRIAL DIVISION

Dept. PW-6 120 So. LaSalle Street, Chicago 3, Illinois

Superiority of Rubber-Tired Bituminous Paver Finisher... Proved Again!

8 Blaw-Knox Model PF-90's Working on Florida Turnpike

The Model PF-45 is on Rubber Too!

The same advantages of rubber-tired mounting apply to the little brother to the Model PF-90. The smaller Blaw-Knox Model PF-45 Black Top Paver is also mounted on wheels and designed to handle smaller paving jobs such as parking lots, driveways, streets and alleys.

Low maintenance, speed and maneuverability of rubber-tired mounting have made the Blaw-Knox Bituminous Paver Finisher the first choice of contractors on Florida's Sunshine State Parkway, a 110-mile turnpike, when they have to order new equipment. The number of these high production units has steadily increased to 8 since the first Blaw-Knox PF-90 laid the first yard of asphalt paving on this job. Approximately 75% of the bituminous pavement on this turnpike was laid by these PF-90's.

Contractors who have worked on the nation's biggest bituminous paving projects have learned that with the Blaw-Knox Model PF-90 Bituminous Paver Finisher mounted *on wheels they can definitely pave for less.* Rubber-tired mounting reduces maintenance by eliminating 500 to 600 exposed metal wear-parts common to crawler mounted pavers and by absorbing vibration which also causes wear and tear on a machine.

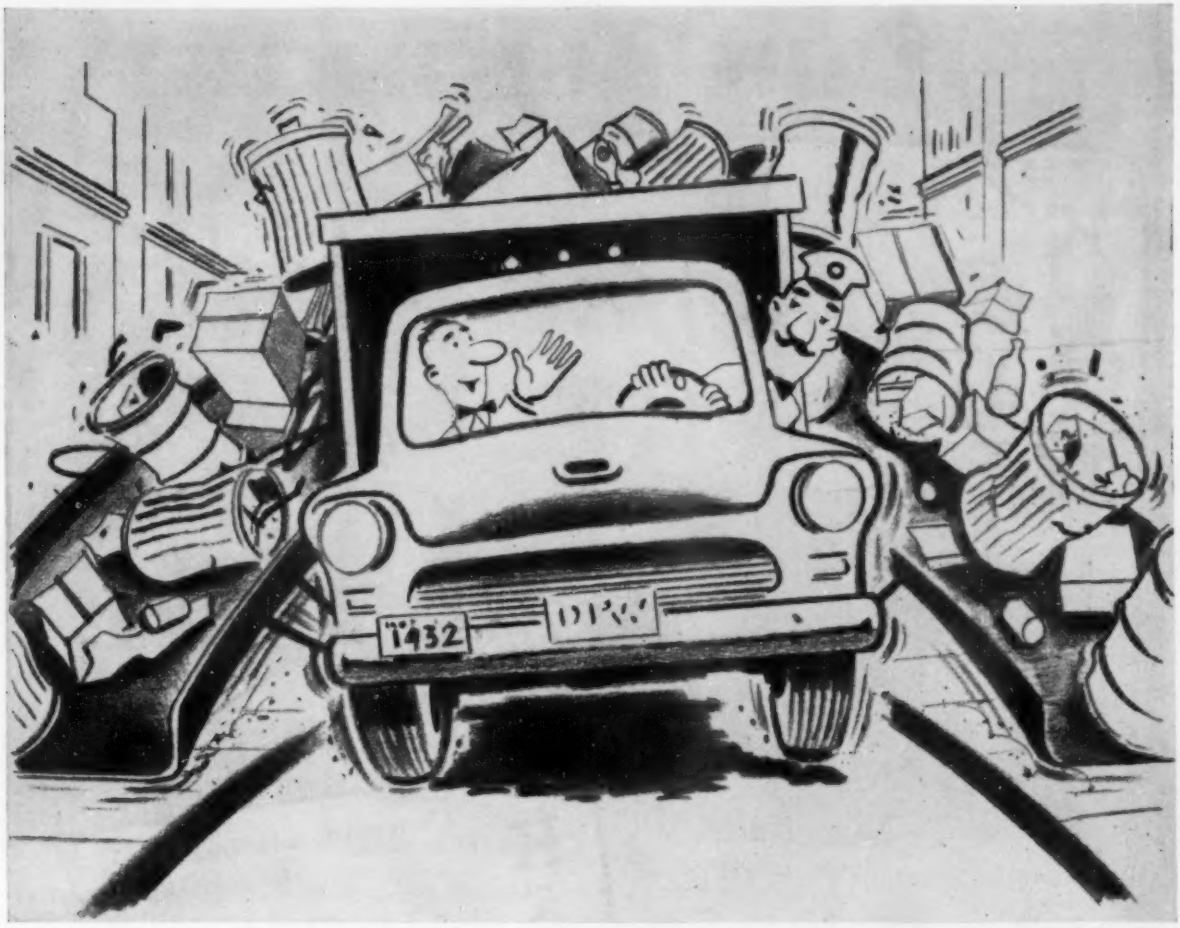
Wheel mounting also speeds returns for restarts to assure a hot longitudinal joint. Other features which contractors like include the extra wide paving widths of 14', 15' and 16', the big 10-ton capacity hopper and the rugged construction.

For complete information on these high capacity bituminous pavers see the Blaw-Knox Bulletin No. 2475. You can get it at your nearest Blaw-Knox Distributor or by writing directly to Blaw-Knox.

BLAW-KNOX COMPANY

Construction Equipment Division

43 Charleston Ave., Mattoon, Illinois



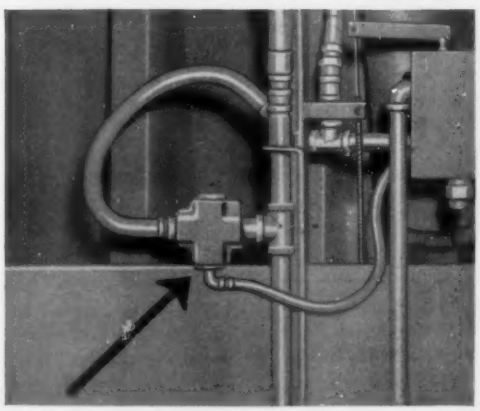
FASTER REFUSE COLLECTION . . . THE HARD WAY!

There's a better method—use Hydro E-Z PACKS

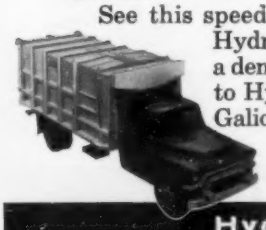
You can speed up your refuse collections without resorting to impractical methods or the use of costly, complicated and hard-to-maintain equipment.

Put Hydro E-Z PACKS to work on your routes. They pack refuse much tighter . . . hold much more, size for size . . . make fewer trips to the dump. And, their high speed platen operation packs faster . . . eliminates loading delays. What's more, exclusive quick-acting single lever tailgate control speeds unloading . . . gets the truck back on the route sooner!

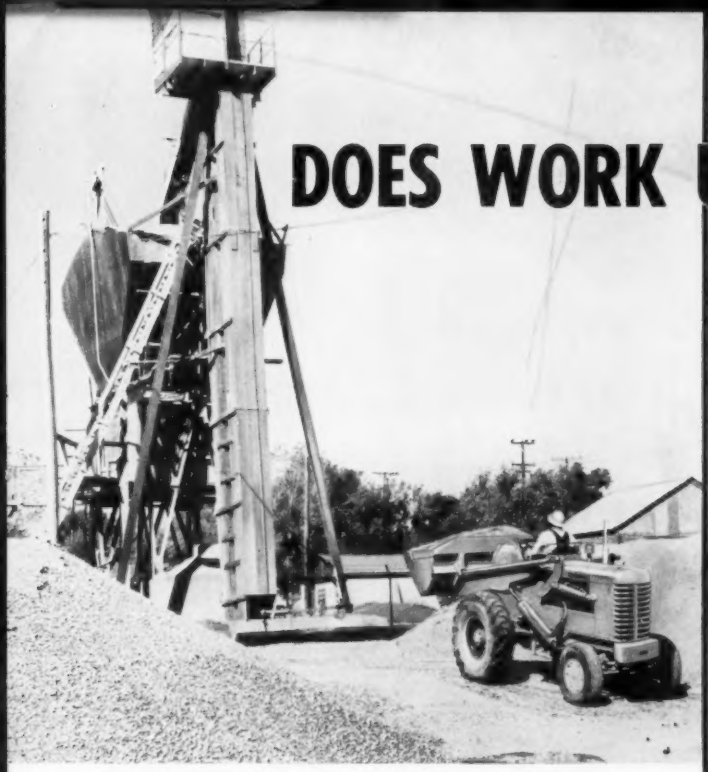
See this speed in action. Ask your local Hydro E-Z PACK distributor for a demonstration. Or, write direct to Hydro E-Z PACK Company, Galion, Ohio. AA-5802



High output pump and this automatic valve triples platen speeds —loading area is cleaned of refuse in seconds!



Hydro E-Z PACK Company • Galion, Ohio



DOES WORK USUALLY HANDLED BY CLAMSHELL

...plus many other jobs

HOW IT'S DONE At left is over-all view of bucket elevator with a two-compartment overhead bin — one for sand, one for gravel. At the base of elevator is a ground level hopper which is kept filled by the TL-11 TRACTO-LOADER (below).

Operator said he likes the stability of the TL-11—carries heaping loads without rocking. In the TL-11, you get the long wheel base and strong construction of the 4-wheel drive TL-12 TRACTO-LOADER . . . plus the short turning radius of the 2-wheel drive TL-10.

versatile

TRACTOMOTIVE TL-11 TRACTOLOADER®

keeps down operating cost for ready-mix plant

No big, expensive, single-purpose machines for Ready-Mix Concrete, Muskogee, Oklahoma. Its low-cost TRACTO-LOADER keeps the bins well-supplied with sand and gravel . . . and fills in "waiting periods" by doing other jobs — transports concrete pipe, reinforcing wire and rods, concrete block . . . loads cinders . . . does general yard cleanup work.

Equipment that keeps producing all day, every day, keeps your income up, your costs down. Ask your Allis-Chalmers construction machinery dealer to show you the multi-purpose TRACTO-LOADERS. Choice of five models; gasoline and diesel.

FLOOR WORKING AREA IS KEPT LEVEL with the TL-11 because operator has hydraulic control of bucket — no digging below grade. Loads are heaped, too, because there is a scooping action with TIP-BACK BUCKET and smooth, positive crowding with HYDRAULIC TORQUE CONVERTER DRIVE.

BUCKET CAPACITY: 1⅛ cu yd
BRAKE HP: 63 (gasoline)
77 (diesel)

SPEEDS: 4 forward; up to 20 mph
4 reverse up to 25 mph
WEIGHT: 11,300 lb (gasoline)
11,500 lb (diesel)

TRACTO — *a sure sign of modern design*

SOLD AND SERVICED BY YOUR ALLIS-CHALMERS CONSTRUCTION MACHINERY DEALER

Send For Free Descriptive Catalog
On The Complete Line Of Tracto-Loaders

TRACTOMOTIVE

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☐ Please send TRACTO-LOADER Catalog
☐ Have salesman call

Name.....
Title.....
Company.....
Address.....
City..... State.....

Lighting Standards and Sign Spans by P & K blend into that pleasant "Florida Look" on the Sunshine State Parkway

An outstanding example of distinctive design and far-sighted planning, the Sunshine State Parkway may well be a model for many future traffic arteries.

From start to finish, the accent was on beauty, safety and economy, generously sprinkled with welcomed originality.

Naturally, modern thinking demanded modern materials. Clean, bright, lightweight and strong P & K aluminum products were specified and installed wherever possible... from lighting standards to over-the-road sign spans. No rust, no painting, high resistance to corrosion... and no maintenance, despite the characteristic sea air of healthful Florida.

Write for the latest P & K catalogs on highway lighting and traffic control products... and use the P & K planning and advisory services without obligation.

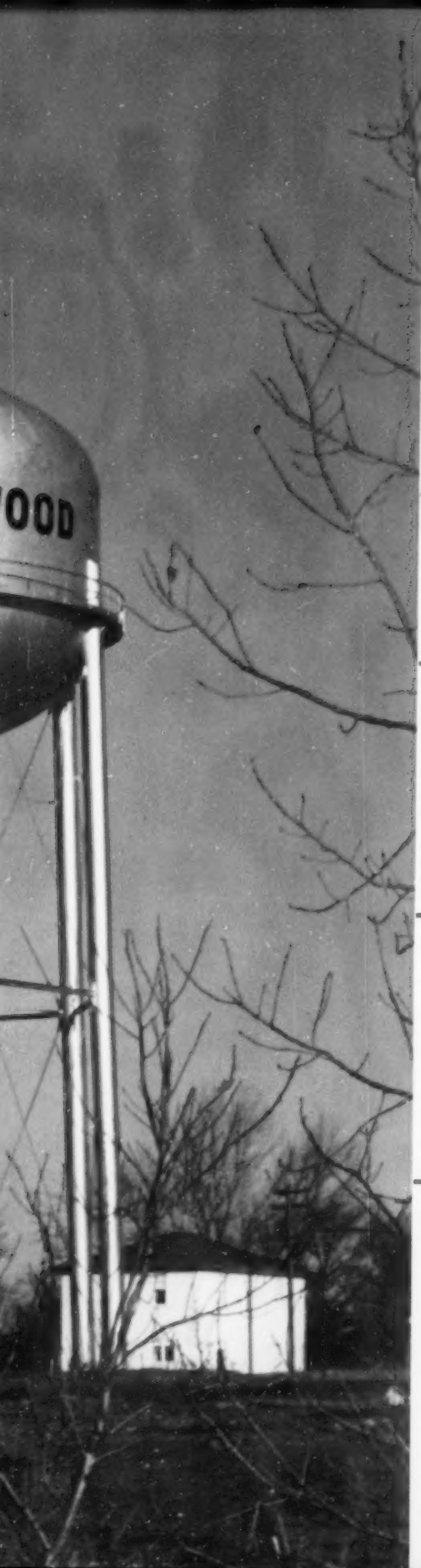
P&K PFAFF & KENDALL
84 Foundry St., Newark 5, New Jersey

P & K SEAMLESS TAPERED ALUMINUM LIGHTING STANDARDS ARE INSTALLED AT ALL INTERCHANGES AND SERVICE AREAS. P & K SIGN SPANS HELP GUIDE MOTORISTS ALONG ENTIRE PARKWAY.

DESIGNED, FABRICATED AND ERECTED BY

GRAVER


HOMEWOOD



FILE REFERENCE

FACT SHEET

GRAVER®

Elevated Water Tank for the Village of Homewood, Illinois

T. G. Bernhardi, Village President
Alan Webster, Village Manager
Baxter & Woodman
Consulting Engineers
Crystal Lake, Illinois
Graver Tank & Mfg. Co., Inc.
Design, Fabrication and Erection

Type: Double Ellipsoidal Elevated Tank
Capacity: 500,000 gallons
Height to Overflow: 101′ 8″
Low Water Level: 71′ 8″
Diameter of Tank: 55′ 0″
Built to AWWA Specifications
Painted and Sterilized

THE PROBLEM

Homewood, a rapidly expanding suburban community which has increased in population from 5,887 to 10,600 from 1950 to 1953, found itself with serious water distribution problems. While new wells and new storage tanks had been added over the years as demand dictated, and total well capacity was ample, the system had become badly out of balance. Mains were not adequate to maintain optimum pressure in all sections of the village. A large part of the growth was in the west side of town, where no storage existed to meet peak demands.

THE SOLUTION

The application of standard empirical formulae indicated that the addition of a 500,000 gallon elevated tank in the west section and the addition and replacement of certain water mains would provide normal water pressure for all areas. This work, it was concluded, would be adequate to take care of the 21,500 population that is expected by 1980.

Graver was selected to design, fabricate and erect the new 500,000 gallon elevated water tank. The contract covered a turnkey job, including construction of foundations, making the pipe connections, painting, sterilizing, grading and seeding.

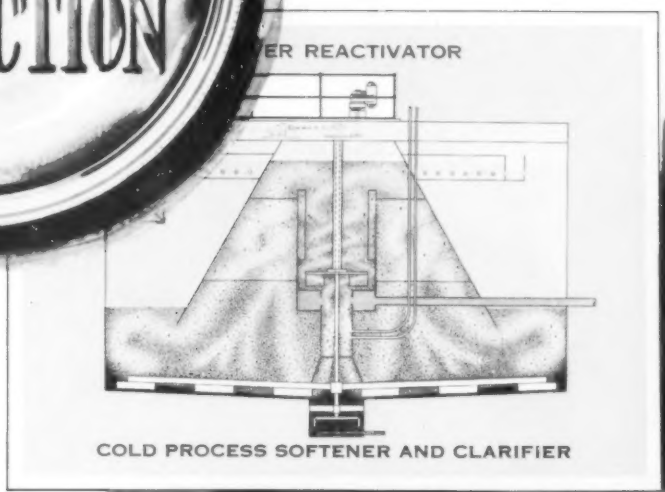
It will be advantageous to talk over your water storage problem with a qualified consulting engineering firm and Graver. Graver's 100 years of experience in tank fabrication and erection, employing the most advanced techniques, is worth having. Telephone or write:

GRAVER TANK & MFG. CO., INC.
EAST CHICAGO, INDIANA

New York • Philadelphia • Edge Moor, Delaware
Pittsburgh • Detroit • Chicago • Tulsa • Sand Springs, Oklahoma • Houston • Los Angeles
San Francisco • Fontana, California

Our 100th Year

DESIGN of DISTINCTION



The distinctive design of the Graver Reactivator®, proven in hundreds of installations, combines *all* four of these important features in *one* unit: *1. Controlled Sludge Recirculation, 2. Separately driven Sludge Scraper, 3. Low Sludge Level, 4. Sludge removal over entire bottom area*

WRITE FOR
DESCRIPTIVE
CATALOGUE
WC-103A

GRAVER®

Municipal Dept. M-113

GRAVER WATER CONDITIONING CO.

A Division of Graver Tank & Mfg. Co., Inc.

216 West 14th Street, New York 11, N. Y.

For low-cost, long-term weed control . . . use Du Pont **TELVAR**® weed killer

monuron or diuron

• Note how "Telvar" has kept the treated area free of vegetation. Untreated area at left shows type of heavy weed growth involved. "Telvar" comes as a wettable powder and is easy to apply with regular spraying equipment.

Just one application of a Du Pont "Telvar" weed killer controls weeds for a season or longer. That's because "Telvar" kills weeds through the roots, then remains in the soil to provide residual action long after the initial spray is applied. Low dosages mean a saving in handling and storage space. "Telvar" weed killers are non-corrosive to equipment, non-volatile, low in toxicity to humans and animals. For low-cost, long-term control of weeds, include "Telvar" in your program.

FOR BRUSH CONTROL . . . use Du Pont "Ammate" X weed and brush killer. It's the chemical brush killer with built-in safety; can be used even where treated areas adjoin sensitive croplands like tomatoes, soybeans, cotton, grapes and other crops. "Ammate" X is non-volatile; there are no vapors to drift onto crops.

FREE ILLUSTRATED BOOKLETS describe how to control weeds and brush with Du Pont chemicals. Write to Du Pont, Grasselli Chemicals Dept., Rm. D-4032, Wilmington, Del. In Canada, Du Pont Company of Canada (1956) Ltd., 85 Eglinton Ave., E. Toronto 12, Ontario, Canada.

DU PONT Weed and Brush Killers

REG. U.S. PAT. OFF.

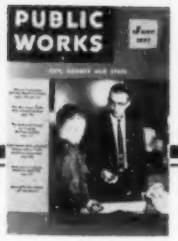
BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

ONE-PASS SHOULDER MAINTENANCE

It takes only one quick pass with an Allis-Chalmers Model D motor grader and shoulder maintainer to keep road shoulders in shape. The D's steady, sure control, wide range of working speeds, plus ample power for engine and hydraulics, make a smooth, even job. It's done safely—in an off-the-road operation. Result—a smooth, safe, well-drained shoulder.

In addition, you can't beat the D for versatility. When shoulders are in top shape, just replace the maintainer with an easily interchangeable ⅝-cu yd bucket. Then you're ready to handle stockpiling, loading trucks, backfilling, and your regular maintenance jobs. Be sure to check the Model D's many big-grader features at your Allis-Chalmers construction machinery dealer. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wis.

ALLIS-CHALMERS *Engineering in Action*



James W. Spencer is highway research and extension engineer (associate professor) in the Department of Agricultural Engineering at Cornell University. From 1949 to 1951, when he received the Master of CE degree, he instructed in highway engineering and surveying in the School of Civil Engineering at Cornell. In his present assignment, he divides his time between extension work with town and county highway superintendents in New York and research in the local rural road field. He is chairman of the annual School for Highway Superintendents at Cornell and editor of an annual *Highway Superintendents Digest* published by the College of Agriculture. He prepares a monthly column "Cornell Highway Extension Notes" in the publication, *Highway Topics*, and has written several articles concerning local rural roads. He reports that being on the staff of the College of Agriculture has made him a supposedly informed consultant on barnyards and farm driveways.

In the fall of 1954, Mr. Spencer spent a brief period in Goias, Brazil, on a field study of the engineering characteristics of the soils in the new Federal District of Brazil.

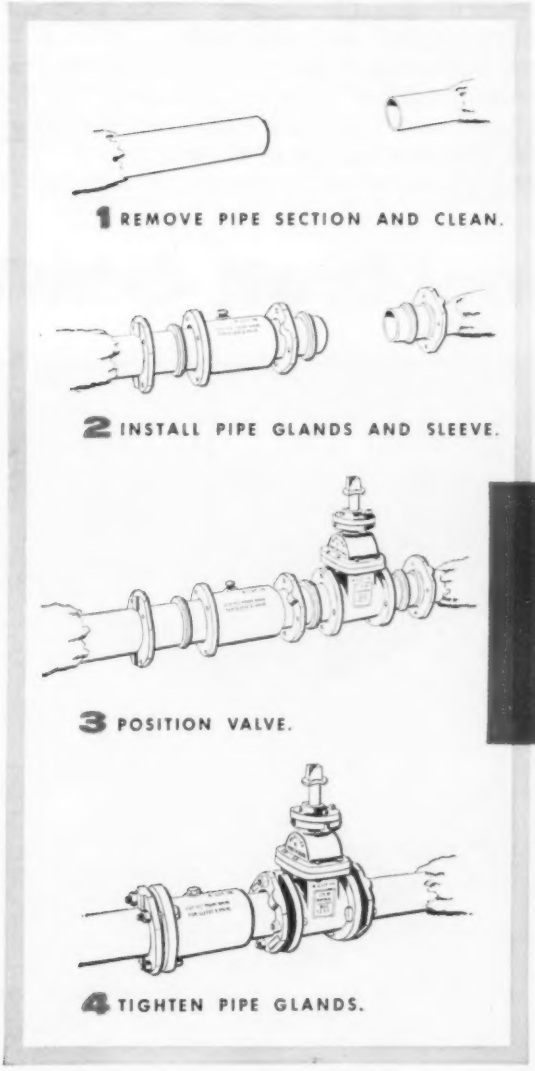
He is licensed as a professional engineer and land surveyor in New York. He has been active in the Educational Division of the ARBA, serving as President in 1956. Previously, he was on the Board of Directors of the Educational Division and chairman of its Committee on Highway Conferences, Short Courses and Extension Work. He is an associate member of ASCE and a member of the Highway Division's Committee on Publications. Affiliation in other technical and professional organizations includes the Highway Research Board, Sigma Xi, Tau Beta Pi, Chi Epsilon and Pyramid. He is a Naval Reservist (CEC) attached to Reserve Research Company 3-11 in Ithaca, N. Y. He and Mrs. (Dorothy) Spencer live in Ithaca with their two children—Jim and Karen.

MUELLER®

cut-in sleeve and valve

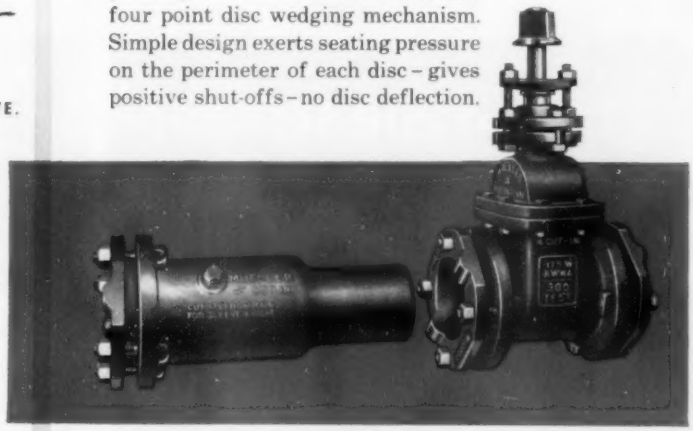
add control points on the line

You can install additional control points on an existing main with a minimum of inconvenience. A short section is cut out of the main and the Mueller Cut-In Sleeve and Valve installed quickly, easily and at low cost without breaking pipe joints.



The sleeve and valve are equipped with mechanical joint-ends to give fast, permanent connections. A choice of end gaskets for different classes of pipe assures a leak-proof connection. This permits installation of a valve and sleeve of a nominal size on virtually any class of pipe normally used for distribution.

The Mueller Cut-In Valve, available with conventional or "O" ring stem packing, has the exclusive Mueller four point disc wedging mechanism. Simple design exerts seating pressure on the perimeter of each disc – gives positive shut-offs – no disc deflection.



Mueller Cut-In Sleeves and Valves in 4", 6", 8", 10" and 12" sizes can give you the versatility of localized control in your distribution system. Ask your Mueller Representative for information, or write direct.

MUELLER CO. 100 YEAR QUALITY SERVING THE WATER AND GAS INDUSTRIES

MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

Since 1857

Four-for

ONLY YOUR International distributor *can make this deal:*

Buy your job-sized 4-In-1 on tracks or rubber from a complete line of profit-producing rigs.

Now—why tie-up useful money or "strap" your credit by "over-equipping"? Why spend upwards of four times as much for several limited-duty machines which one 4-In-1 can replace—and outproduce?

An International Drott 4-In-1 gives you 4-machine usefulness for one moderate investment. Yes, the exclusive and revolutionary 4-In-1 gives you instant availability of 4 big-capacity machine actions!

You get world-beating Skid-Shovel excavating-

All-in-1 International Drott 4-In-1

"Carry-type scraper"

with "see-easiness" of front-mounting—to *grade, strip, spread,* or *compact* with amazing, inch-close accuracy!

Skid-Shovel...

with Drott's exclusive, "concrete-smashing," triple-power pry-action break-out—and 42° ground-level bucket roll-back!

machine job-capacity One-machine price!

loading performance. You get exclusive multi-purpose "carry-type scraper" action. You get production-boosting clamshell action. You get "radius-controlled" bulldozer action with big-yardage earth-rolling ability!

You get 4-In-1 versatility unlimited for a fraction of the price of the machines it can replace and outperform, on job after profitable job!

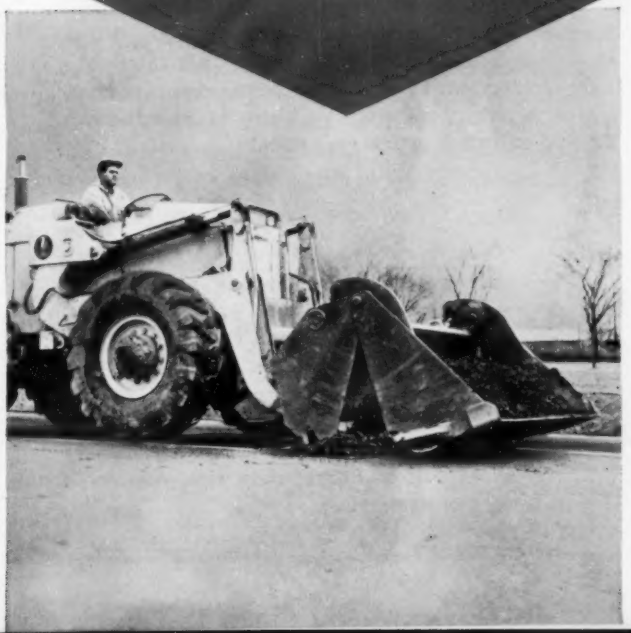
And you can have 4-In-1 advantages teamed with all-condition International crawler traction, or rubber-tired Hough Payloader speed!

See your International Distributor—he's the only one who can offer you a 4-In-1 deal! He's the only one who can save you the thousands of dollars that 4-In-1 ownership assures—by giving 4-machine utility for one moderate investment. And he can prove the "heap of difference" in 4-In-1 performance on tracks or rubber—against anything else in the field! See him soon for a demonstration!

gives you...

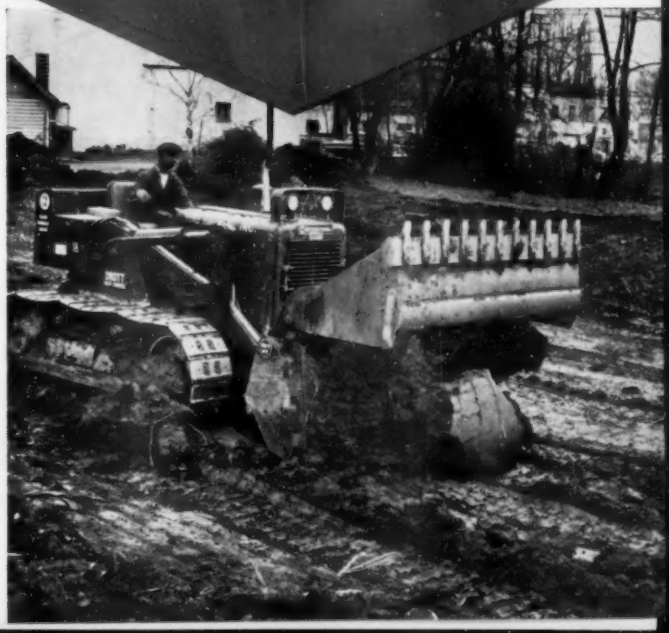
Clamshell...

that "surrounds" loose materials and fills in one fast gulp—gives you "hopper-high," self-cleanout dumping action.



Bulldozer...

with clam lip up, and skid shoes on the ground, the radius-controlled blade rolls the earth with precision!

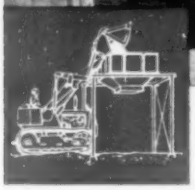


ONLY YOUR International distributor CAN OFFER THESE EXCLUSIVE FEATURES!

Here's job-range . . .

Exclusive triple-power pry-action break-out

Inbuilt ability to deliver tremendous excavating force enables this TD-9 4-In-1 to yank out deeply embedded old masonry piers. You see typical, on-the-job advantages of true and exclusive International Drott pry-over-shoe break-out action—the only design that gives you the three absolute essentials: (1) Full hydraulic power transfer from full piston-face power-push; (2) Long lever to apply full pry-power; (3) Fixed fulcrum of frame-mounted skid-shoes, to concentrate pry-force!



Exclusive parallelogram raise action

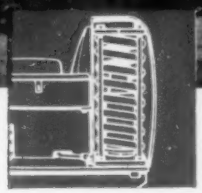
No eccentric tipping to cause spill-back and lose yardage! The 4-In-1 has non-spill, roll-back level—all the way up. Compared to ordinary front-end loader performance, this feature, alone, can increase your daily yardage up to 18%! You can bottom-dump the 4-In-1 as a clamshell...and do it 2½-foot higher than ordinary roll-forward buckets. And bottom dumping eliminates the sticky materials problem—where other rigs foul up and can't get the job done!

Check these other famous International Drott Exclusives!

- **STANDARD EQUIPMENT.** Three-valve design, to provide hydraulic control power for attachments.
- **STANDARD EQUIPMENT.** Double-bottom, bridge-truss bucket to insure 4-In-1 strength to match pry-action.
- **STANDARD EQUIPMENT.** Yoke-type supports to insure linkage strength to back 4-In-1 capacity!
- **STANDARD EQUIPMENT.** Magnetized dip stick to prevent damage to hydraulic system from minute abrasives!

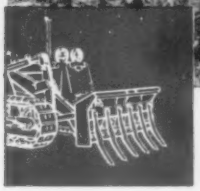
Only your International Distributor can offer you the big money-making advantages of International Drott exclusive 4-In-1 features. Only he can deliver you job versatility unlimited, in the world's only multi-purpose machine of its type! Prove to yourself that your correct size of 4-In-1 can replace and outperform a whole machinery yard full of limited-duty rigs. Ask for a demonstration!

where 4-in-1 gets world-beating ... capacity... stay-put performance!



Exclusive shock-swallowing Hydro-Spring

Capacity-boosting, machine-protecting Hydro-Spring is a hydraulic cylinder enclosed in a heavy-duty locomotive-type coil spring. Shock force displaces oil from main lift cylinders into the Hydro-Spring cylinder—extending it and compressing the big spring to absorb and cushion impact loads. Slamming the 4-In-1 bucket into hard material—'dozing frozen ground—dumping rock with a bang—you never worry! Hydro-Spring gentles trouble-causing forces by two-thirds or more—practically eliminates hydraulic hose failures!



Complete line of attachments

Job-getting, money-making attachments built for specialized duty, provide tree-grubbing, boulder-bucking, log-loading performance available only from International Drott equipment! Grubber Blade attachment, used in place of the 4-In-1, is shown applying the tremendous force of pry-action break-out—to uproot a tough old oak tree. Other special attachments built to extend International Drott advantages to other fields include: Rock Forks, Skid-Grapples®, Bulldozer and Bullangledozer blades!

CHOOSE FROM

four 4-in-1 sizes

TRACTOR SIZE	4-IN-1 CAPACITY
TD-6	1-YARD
TD-9	1½-YARD
TD-14	2¼-YARD
TD-18	3-YARD

International Harvester Company, 180 N. Michigan Ave., Chicago 1, Ill.
Drott Manufacturing Corp., 3126 South 27th St., Milwaukee 15, Wis.

INTERNATIONAL HARVESTER

INTERNATIONAL® DROTT®

ONLY

your International distributor can give you 4-in-1 Performance *ON RUBBER!*

NO-STOP POWER SHIFT

One lever makes all shifts forward and reverse under full throttle — no clutching, no stopping. Torque converter provides infinite speed ratios.

PAYLOADER® mobility

PLUS four-machine utility

The only rubber-tired tractor-shovels available with Drott 4-in-1 buckets

Now you get even more tractor-shovel performance when you buy a "PAYLOADER". Equipped with a Drott 4-in-1 bucket, your "PAYLOADER" can handle many jobs that other wheeled tractor-shovels can't touch . . . perform shovel, clamshell, scraper or bulldozer work that would otherwise require several separate machines.

With a Drott 4-in-1 on a "PAYLOADER" you also get:

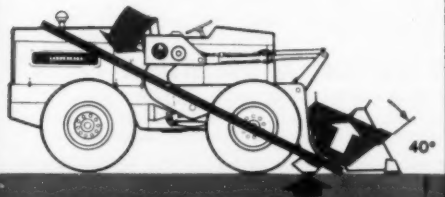
MOBILITY — quick-to-job travel over streets or highways under its own power . . . ability to work on or off paved surfaces.

MANEUVERABILITY — easy operation and fast loading cycles because of responsive rear-wheel power steering, "no-stop" finger-tip power shifting, dependable 4-wheel power brakes.

BALANCE AND STABILITY — long wheelbase . . . hydraulic load-shock-absorber . . . low, close bucket-carry position, all contribute to the easier riding qualities, the higher carrying speeds and the unusual balance that are outstanding "PAYLOADER" operating advantages.

TRACTION AND DIGGING POWER — exclusive power-transfer differentials, planetary final drives and the powerful pry-out bucket digging action help these "PAYLOADER" units to outperform other tractor-shovels of comparable size. Your International Distributor is anxious to demonstrate what these "PAYLOADER" tractor-shovels with a Drott 4-in-1 bucket can do for you. Ask him about the "PAYLOADER" Deferred Payment Plan.

PRY-OUT DIGGING ACTION

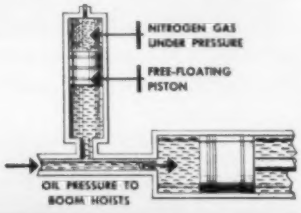


Exclusive "PAYLOADER" bucket action combines a powerful prying force over "break-out" pads, with 40° bucket tip-back *at ground level* to get heaped loads into bucket quickly and easily.

POWER-TRANSFER DIFFERENTIALS

These special differentials give better traction under all conditions — automatically deliver 25% more power to the wheels with the better traction.

LOAD SHOCK ABSORBER



This important device is a part of the hydraulic system. It cushions the loaded bucket, smooths the ride, permits faster carrying speeds, reduces spillage, boosts production.

All three sizes of 4-wheel-drive "PAYLOADER" tractor-shovels, models HU, HH and HO, are available with Drott 4-in-1 buckets, sizes 1, 1½ and 2¼ cu. yd. respectively.

SAY "HUFF"

PAYLOADER®

MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

THE FRANK G. HOUGH CO.
761 Sunnyside Ave., Libertyville, Ill.

Send full data on 4-wheel-drive "PAYLOADER" model ( ) with Drott 4-in-1 bucket to:

Name

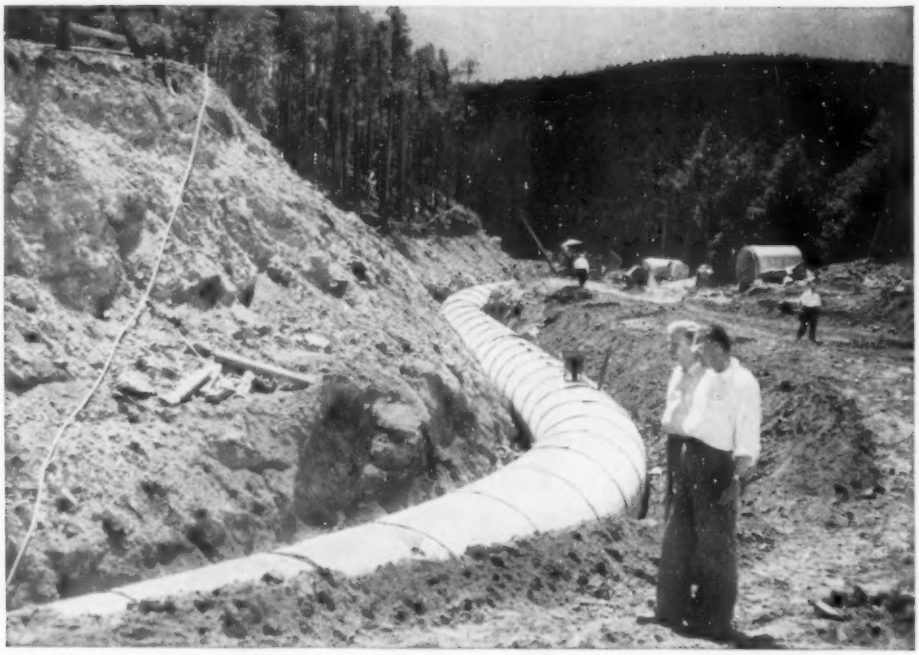
Title

Company

Street

City State

90



S-curve section of 72-in. concrete pipe in place.

DENVER'S MOUNTING WATER NEEDS SUPPLIED WITH 27,000 FEET OF *CONCRETE PIPE*

A shipment of four carloads of 72-in. pipe.

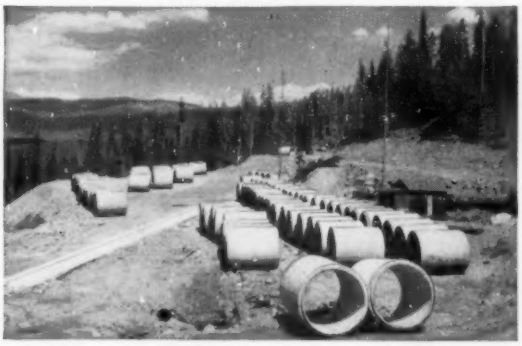
The Denver, Colo. Water Board has made available an extra 19,400 acre-feet of water per year for the city's growing needs with its St. Louis Creek Collection System.

The project, 80 miles west of Denver, required 27,000 ft. of concrete pipe 30 to 72 in. in diameter. Inasmuch as there was no head on these lines, reinforced concrete sewer pipe, ASTM Specification C-75, was used.

Like Denver, many other cities are using concrete pipe to supply their ever-mounting water needs. That's because concrete pipe water lines provide maximum capacity plus great strength and extra long life. No tuberculation or incrustation difficulties lower their hydraulic efficiency. The final result is true ***low-annual-cost*** water line service.

PORTLAND CEMENT ASSOCIATION
33 West Grand Avenue, Chicago 10, Illinois
A national organization to improve and extend the uses of portland cement and concrete . . . through scientific research and engineering field work

Three truckloads of 72-in. pipe enroute to job.



Contractor's pipe storage yard at the job site.

One application controls dust all season!
GULF SANI-SOIL-SET

Gulf Sani-Soil-Set is the effective, economical answer to your dust annoyance problems. Here's why...

TAKES EFFECT INSTANTLY. Sani-Soil-Set coats and permeates surface soil evenly, anchoring the dust immediately. No long waiting periods are necessary before the ground is ready for use.

ONE APPLICATION LASTS ALL SEASON. Rain does not wash Sani-Soil-Set away—sunshine does not affect it. One application is usually sufficient to keep dust down for an entire season, so costs are minimized.

EASY TO APPLY. Sani-Soil-Set is a free-flowing liquid, not a tar. It has no offensive odor. It can be hand-sprinkled or applied by sprinkling truck and spreads quickly.

MAKES YOU A BETTER NEIGHBOR. Sani-Soil-Set prevents dust from blowing into nearby buildings and homes. Your neighbors will appreciate Sani-Soil-Set's effectiveness.

Gulf Sani-Soil-Set has proved an efficient dust allayer for playgrounds, athletic fields, parking lots, race tracks and other bare-earth areas. You can have a free demonstration simply by contacting your nearest Gulf office. For more information, mail coupon for descriptive pamphlet.

GULF

GULF OIL CORPORATION PW
1822 Gulf Building, Pittsburgh 30, Pa.
Please send me a copy of your free pamphlet, "Gulf Sani-Soil-Set —the modern, proven agent for controlling dust."

Name_____

Title_____

Address_____

City_____ Zone____ State_____

EQUIPMENT and MATERIALS

FOR YOUR

PUBLIC WORKS PROGRAM

NEW LISTINGS

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

Power Loader For Handling Heavy Materials

689. This power loader fits any standard truck chassis and is operated from a power take-off through the engine transmission. For complete specifications and data write Daybrook Hydraulic Div., L. A. Young Spring and Wire Corp., Bowling Green, O., or check the reply card.

Pipe-Pusher Attaches to Tractor-Mounted Hydraulic Backhoes

690. Pipe pushing is a one-man operation with the Pow-r Mole that is described in literature available from Pow-r Devices, Inc., Clarence Center Road, Clarence Center, N. Y. Unit drives pipe or service lines under roads, streets, sidewalks and lawns. Check the reply card today.

Complete Line of Cleanouts and Access Covers

691. Detailed information on Josam Superseal line of cleanouts and access covers is available from Josam Mfg. Co., Michigan City, Ind. Detail drawings and specifications and a chart of installation locations and installation diagrams are included. Check the reply card.

Handbook on Selecting Power For Pumping

694. A 12-page power selection handbook, "Selecting Power For Pumping," has been released by the Advertising Div., Caterpillar Tractor Co., Peoria, Ill. This handbook is especially useful to those who have a pumping operation. It contains a checklist of features necessary for continued dependable operation on pumping jobs. List describes the proper requirements which an engine must have, backing them with illustrations and examples of efficient installations. Check the reply card today.

Complete Line of Construction Equipment

692. The complete lines of Blaw-Knox equipment for concrete and bituminous paving, ready-mix plants and general construction are colorfully illustrated in a 24-page bulletin. There are 14 basic items of equipment described and also listed are a number of other bulletins that are available. Check the reply card or write Blaw-Knox Co., Construction Equipment Div., Advertising Dept., Mattoon, Ill.

Service Bodies to Suit Your Maintenance Needs

706. Service bodies, tailored to fit the needs of any municipal department and featuring many outstanding features of construction and design, are described in literature of Morrison Steel Products, Inc., 601 Amherst St., Buffalo 7, N. Y. The line has models to fit all popular truck chasses; ½ to 1½-ton; single or dual wheel. Be sure to check the 18 different compartment arrangements and engineered accessories offered for time-saving convenience and efficiency of your maintenance crews.

Automatic Transfer Switches For Power Failure

693. Complete information on automatic transfer switches (mechanically or magnetically held) is covered in Catalog 57-51 available from Automatic Switch Co., Florham Park, N. J. Switches are designed to transfer a load automatically from a normal source to an emergency source upon failure or reduction in voltage of the normal source. Check the reply card.

Fluo-Chlorinator For Fluoridation and Chlorination

695. Catalog 70F140 describes the Fluo-Chlorinator which adds controllable quantities of fluoride and chlorine solution to potable water supplies and it is available from Fischer & Porter Co., 36 Jacksonville Road, Hatboro, Pa. Check the reply card for operation, installation and maintenance information.

Shredding In Preparation of Turf Conditioning Materials

696. A Bulletin entitled "Royer Shredders For Turf Conditioning Materials" describes soil structure and the value of top dressings and similar preparations in soil condition. Write Royer Foundry & Machine Co., 175 Pringle St., Kingston, Pa., for information on the Royer shredder or check the reply card.

Hi-Way Widener Catalog

697. A 4-page catalog covering the Gar Wood-Buckeye Hi-Way Widener is now available from Gar Wood Industries, Inc., Customer Service Dept., Wayne, Mich. The unit excavates and finish grades a highway widening trench in one pass. Check the reply card for full details.

Electronic Traffic Cop Stops Emergency Car Accidents

698. El-Tec. electronic-traffic emergency control, is an UHF-radio system that is used for positive control of traffic along the route taken by an emergency vehicle. Check the reply card or write Electronic Protection Inc., Subsidiary of Standard Coil Products Co., Inc., 2085 North Hawthorne Ave., Melrose Park, Ill., for complete information and specifications.

Bulletin on Line of 3-Wheel Rollers

700. Bulletin #HWR 531 describes in detail both the construction and effective use of Huber-Warco's 3-wheel rollers, standard and variable weight models. Information on the main frame, torque converter, tail shaft governor, 2-speed transmission and the guide roll assembly is included. Check the reply card or write Huber-Warco Co., Marion, Ohio.

Complete Line of Surveying Instruments

524. A catalog from The David White Instrument Co., Milwaukee, Wisc. covers their complete line of surveying instruments. Pictorial and descriptive information of the instruments are included. Check the reply card.

Steel Booths For Parking Lots, Toll Roads and Bridges

701. Three newly-designed standard prefabricated steel booths are described in an 8-page illustrated bulletin from Taller & Cooper, Inc., Brooklyn, N. Y. Bulletin also outlines the services of the company's design department which has facilities to meet specific control and site problems. Check the reply card today.

Water Repellent For Concrete Roads and Bridges

702. "Spallbar" water repellent is designed to reduce spalling of concrete bridges and highways and can be applied as soon as the concrete has set. Check the reply card or write Silicones Div., Union Carbide and Carbon Corp., 30 East 42nd St., New York 17, N. Y. for application, spraying equipment needed and other information.

Catalog on Engineering Instruments

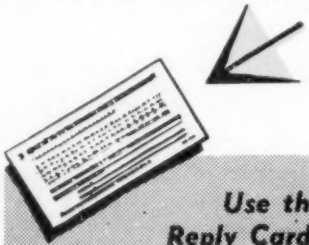
703. A completely revised catalog of engineering instruments is available from W. & L. E. Gurley, Troy, N. Y. Models of instruments are described in detail, explanatory tables printed in two-colors, cross-sectional photographs and drawings showing parts of instruments and repair service are included. Check the reply card today.

Complete Structural Systems and Curtain Wall Panels

704. Available Stran-Steel shapes, applications, installation details, dimensions and properties, safe uniform load tables for Stan-Steel joists and design examples are covered in catalog available from Stran-Steel Corp., Detroit 29, Mich. Check the reply card today.

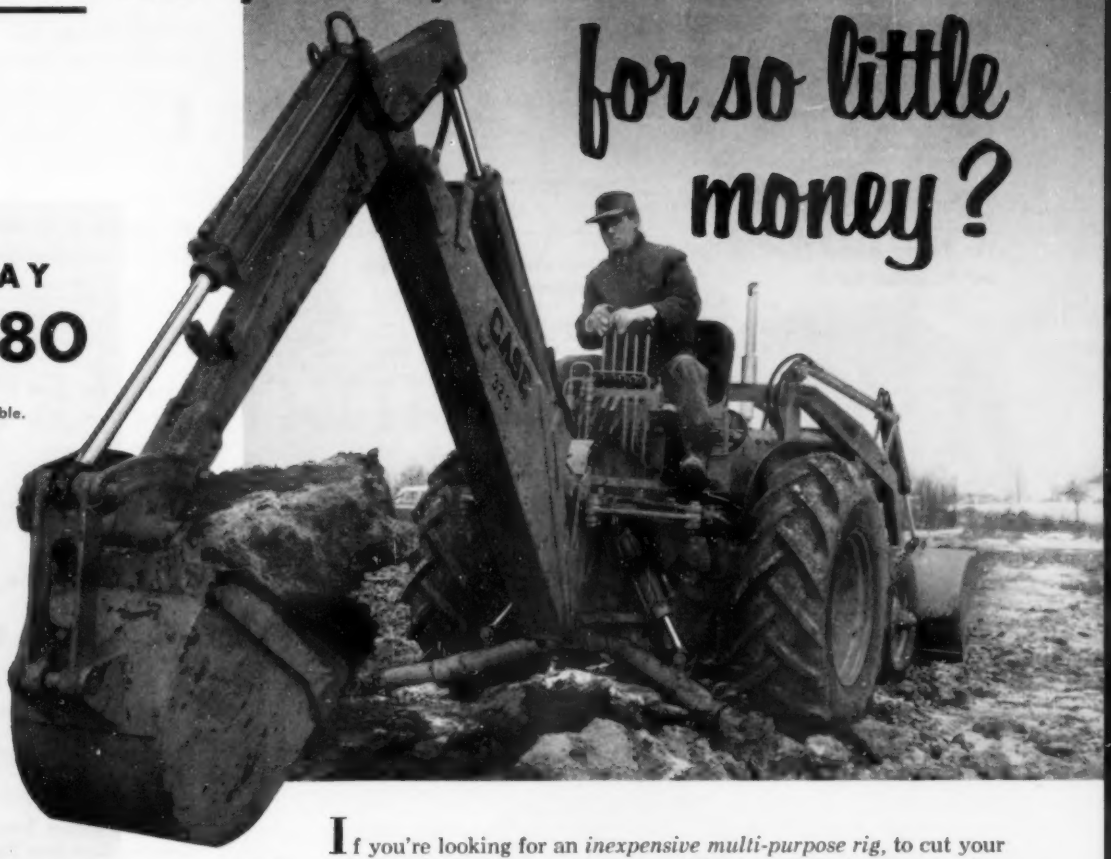
Combination Paver-Spreader Spreads and Compacts Asphalt Material

705. The True-Lay paver-spreader lays a mat from 4 ft. to 10 ft. wide and up to 6 ins. deep. Bulletin HH-33 from Littleford Bros., Inc., Dept. HH-33, 453 East Pearl St., Cincinnati 2, Ohio, gives specifications, operation and auxiliary items. Check the reply card.



Use the Reply Cards For Prompt Service

Where else can you buy so much machine... for so little money?



YOU PAY
just $5,580

FOB Factory,
plus taxes, where applicable.
(Price subject to change.)

YOU GET

- **A heavy-duty industrial tractor** with 148 cu. in. gasoline engine . . . industrial bumper and radiator guard . . . recessed headlights . . . husky one-piece forged steel front axle . . . heavy-duty front wheel bearings, extra-heavy subframe assembly and 13 x 24 6-ply rear tires.
- **Heavy-duty backhoe** with big-capacity pump, telescoping tubular steel stabilizers and hydraulic foot-controlled 180° swing.
- **½-yd. front-end loader** with power-leveling and 60° grading angle.
- **Effortless power-steering** — PLUS famous Case shuttle transmission, which lets you go forward or back-up instantly, at 27% *faster speed in reverse* — WITHOUT SHIFTING GEARS!

CASE

Famous for quality for over 100 years

If you're looking for an *inexpensive multi-purpose rig,* to cut your costs on trenching, loading and clean-up jobs, you'll find that no other machine on the market can match the quality, performance and low price of the new Case 320 *industrial* backhoe-loader. This is because the complete unit — tractor, backhoe, loader, even the engine — is engineered, built and factory-mounted by Case, with only ONE manufacturing profit. No "hidden extras" . . . *no messy split-responsibility on warranty or service.* Best of all, your nearby Case Industrial Dealer will give you "the best deal in town", with *easy monthly payments* that let you pay as you earn. Call him today for the complete story, or mail coupon below for free descriptive literature.

Case also builds a full line of TerraTrac crawlers — from the low-priced 42 HP angle-dozer pictured here — to big 100 HP models, with 2-cu. yd. shovel-buckets. Check coupon for more facts.

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J. I. CASE CO., Dept. F13 7, Racine, Wis., U.S.A.

Send free literature on: ☐ Case 320 Backhoe-Loader
☐ 42 HP TerraTrac Dozer ☐ 2-cu. yd. TerraTrac loader

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Company .....

Address .....

City..... State.....

C-BL-31

industrial wheel and crawler tractors • loaders • dozers • backhoes • fork lifts

To order these helpful booklets check the reply card opposite page 78.

NEW LISTINGS (Cont.)

Information on Whiteprinting Machines

699. The Revolute Star Whiteprinter offers production speeds to 45 ft. per min. with front and rear suction tanks providing positive separation of original and sensitized material. For literature check the reply card or write Paragon-Revolute Corp., 77 South Ave., Rochester 4, N. Y.

The Tampo Rubber-Tired Self-Propelled Roller

707. Information on the Tampo self-propelled roller can be had from Tampo Manufacturing Co., 1146 W. Laurel Street, San Antonio, Texas. The advantages of using this roller and complete general specifications are outlined. Optional equipment for the machine is listed. Check the coupon.

Complete Line of Sewage Pumps

711. This 12-page bulletin illustrates a complete line of sewage pumps that are made by The Deming Co., Salem, Ohio. Check the reply card for information on heavy-duty wet and dry pit sewage pumps, small vertical sewage pumps, and standard and submersible cellar drainers.

Use The Reply Card

Computer Solves Highway Earthmoving Problems

712. A general purpose computer that solves highway earthmoving problems is covered in literature from Bendix Computer Div., Bendix Aviation Corp., 5630 Arbor Vitae St., Los Angeles 45, Calif. Check the reply card for information on how to solve cut and fill problems by computers.

Flexible Plastic Pipe For Water Distribution

708. A new-type polyethylene resin flexible pipe is described in Catalog No. 401 available from Orangebrug Mfg. Co., Inc., Orangeburg, N. Y. Fittings, installation, size and weight tables and physical properties are several of the sections covered. Check the reply card.

Spiragester, A Combination Clarifier and Digester

709. A 22-page catalog is available from Lakeside Engineering Corp., 222 W. Adams, Chicago, Ill. describing the Spiragester. Check the reply card for operation of the unit, advantages, specifications, samplers and painting.

Simplify and Save on Public Works Electrical Construction

710. Information and literature is available from Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa., on how you can simplify electrical details of a public works project. Westinghouse field specialists will help you plan the electrical system to fit your need. Check the reply card.

•

WATER WORKS

Elevated Tanks and Other Storage Facilities

32. Specification sheet covering elevated tank sizes and design and illustrated brochure available from the Darby Corp., Kansas City 15, Kansas.

Ball and Socket River Crossing Cast Iron Pipe

33. Literature is available describing Clow ball and socket cast iron pipe for river crossing, or any installation where full 15 degree free turning deflection is desirable. For full description and specifications, address James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

Meters and Instruments For Water Works

43. An attractively arranged 20-page booklet issued by Sparling Meter Co., 225 No. Temple City Blvd., El Monte, Calif. furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the reply card for your copy, or write for Bulletin 314.

Engineering Information and Water Distribution Products

49. Helpful engineering information, covering water distribution problems, is available from Mueller Company in their W-96 Water Works Catalog. The 328 page catalog features a quick reference sectional indexing arrangement for easy location and identification of the hundreds of water distribution and service products illustrated. Check the reply card and you will receive detailed information on a complete line of water works equipment.

Handbook of Cast Iron Pipes and Fittings

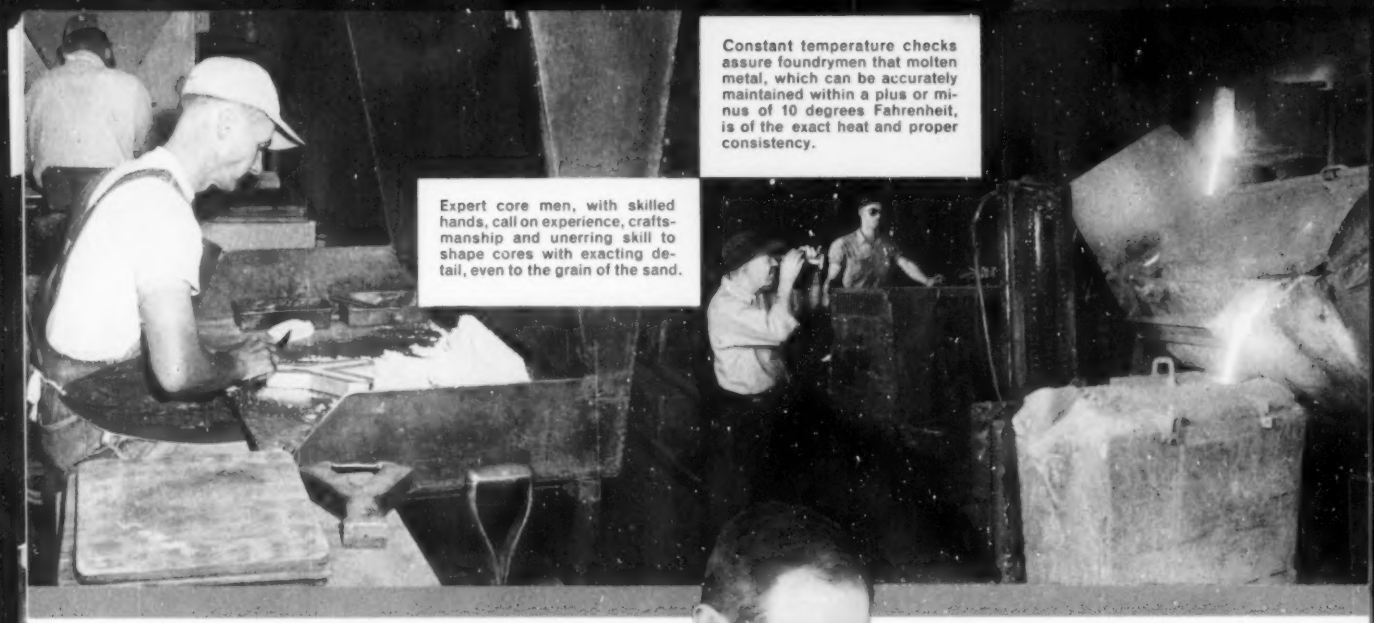
52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use reference. Requests for this valuable publication should be accompanied by your business letterhead.

(Continued on page 42)

Craftsmanship . . .

TRADITION OF A CENTURY

Through a century of service, Mueller Co. has established a tradition of fine craftsmanship, with trained workmen utilizing lengthy experience and expert skills... and with exacting control of quality, materials and modern manufacturing methods...to produce superior, more dependable products for the nation's essential gas and water industries.



Constant temperature checks assure foundrymen that molten metal, which can be accurately maintained within a plus or minus of 10 degrees Fahrenheit, is of the exact heat and proper consistency.

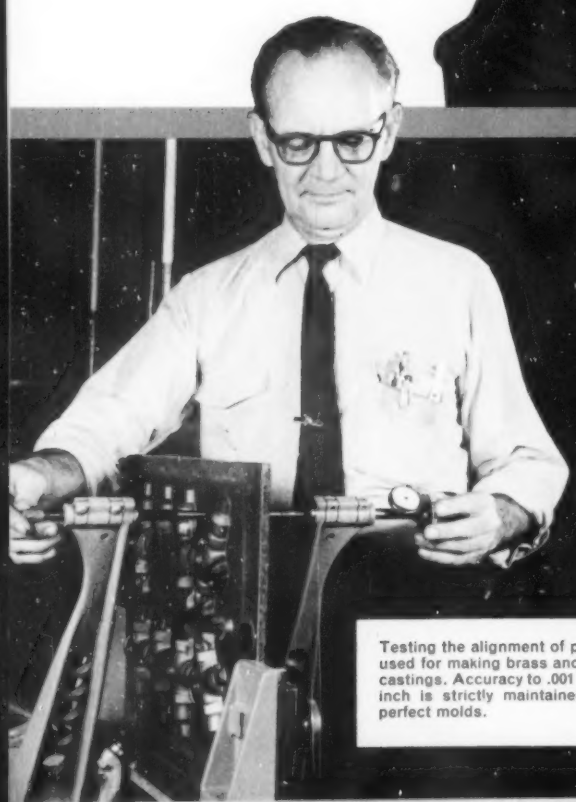
Expert core men, with skilled hands, call on experience, craftsmanship and unerring skill to shape cores with exacting detail, even to the grain of the sand.

Patience...

Pride...

Perfection...

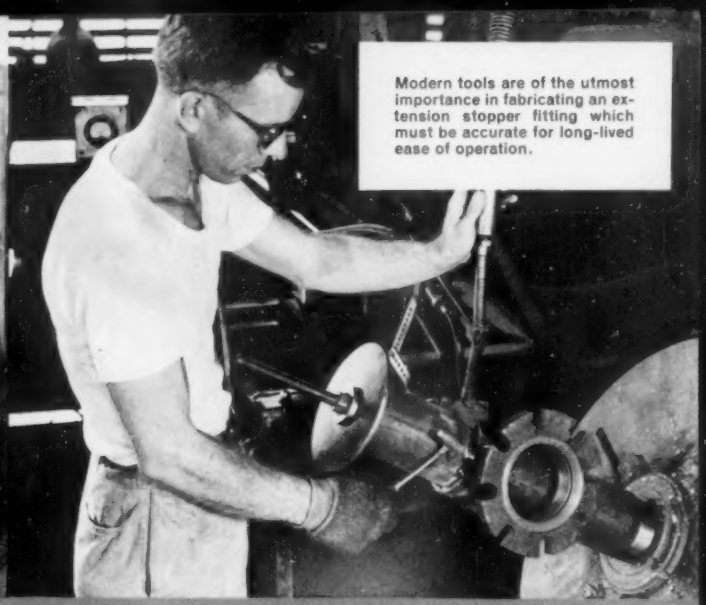
Patterns are shaped and inspected in minute detail to assure exact accuracy and precision. Records of many thousands of patterns and core boxes are maintained in the Pattern Shop for checking purposes.



Testing the alignment of plates used for making brass and iron castings. Accuracy to .001 of an inch is strictly maintained for perfect molds.

Nimble fingers of this master craftsman operate a ground key lapping machine, producing Mueller stops that must have accuracy to .001 of an inch.

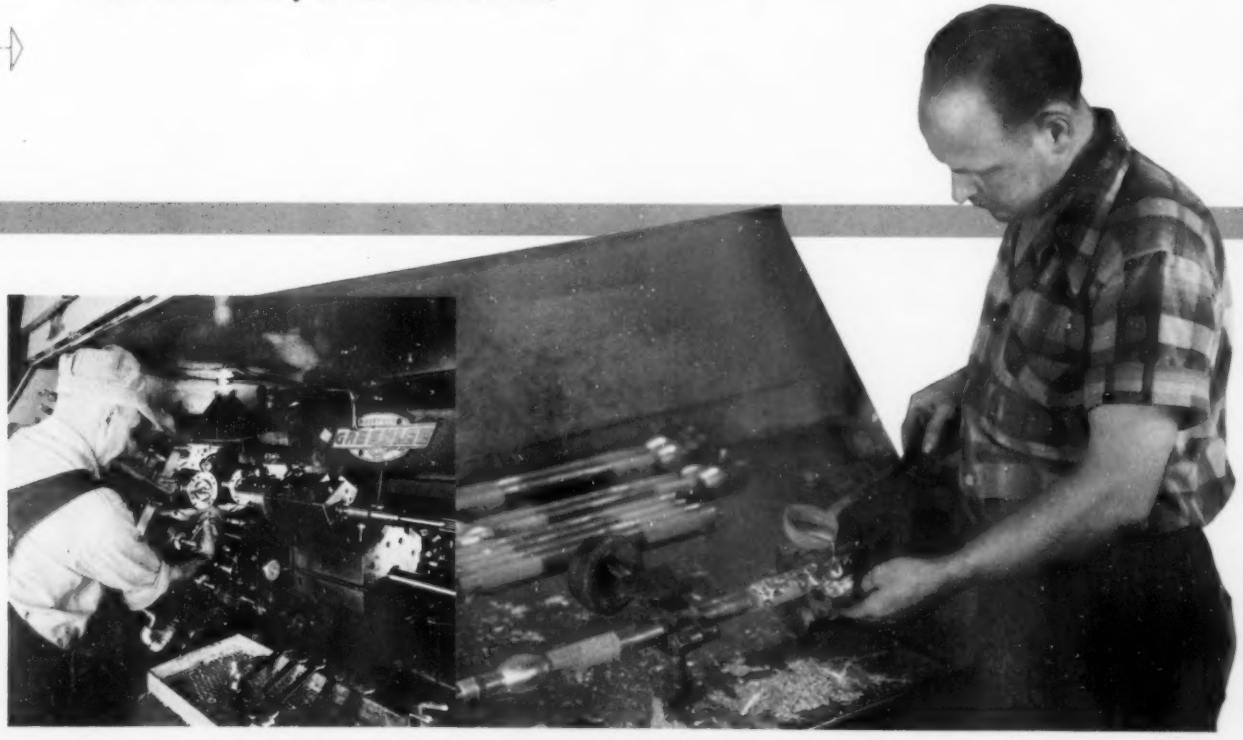
Experienced ladlemen jockey ladles into position to receive white-hot liquid brass. Furnaces melt 2,000 pounds of brass in an hour.



Modern tools are of the utmost importance in fabricating an extension stopper fitting which must be accurate for long-lived ease of operation.

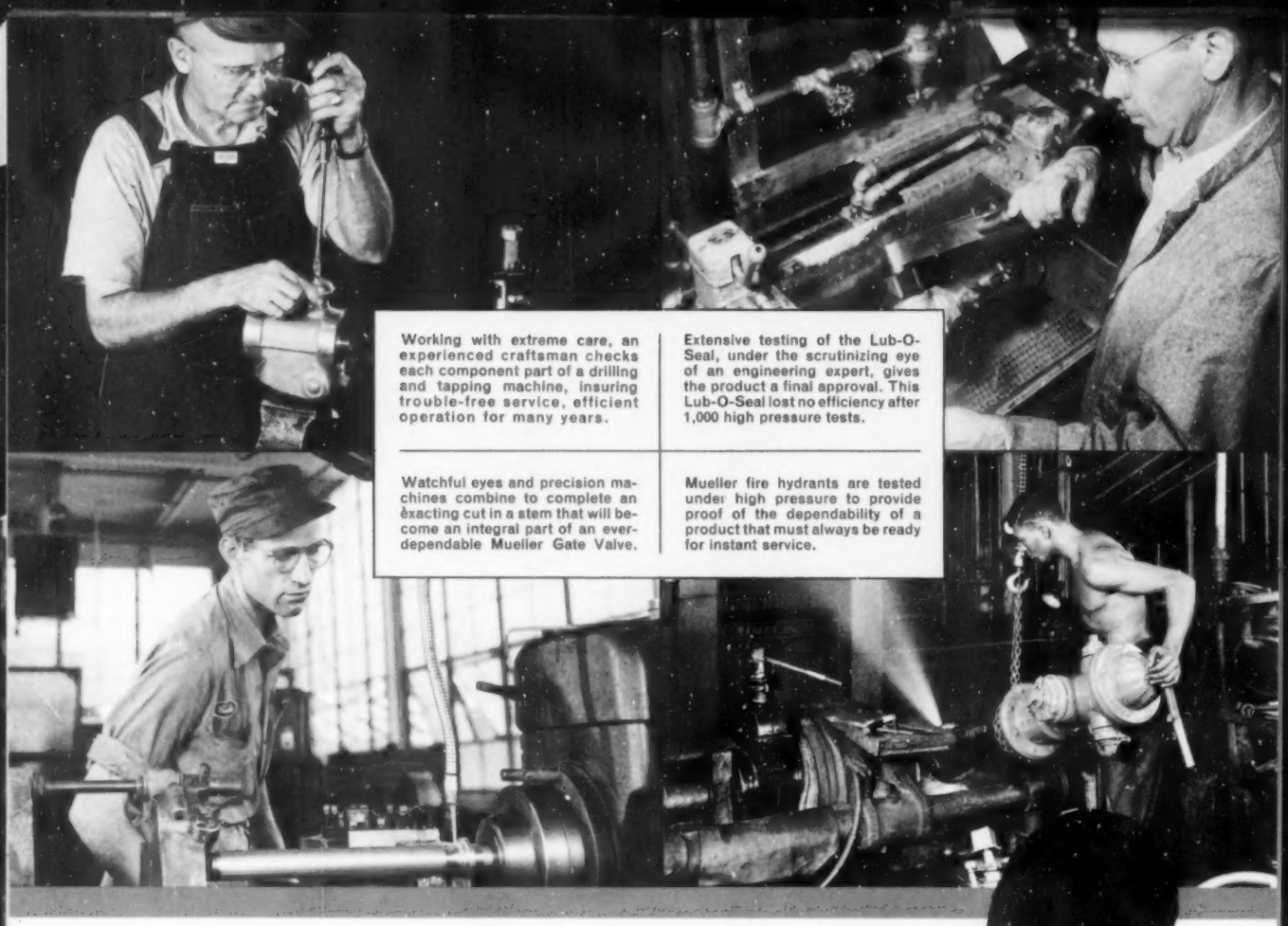
Precision machines cutting gleaming metal to microscopic tolerances... turning conveyor lines carefully carrying partially completed products to assembly points... busy men of many talents adjusting instruments, reading gauges, skilfully performing their work—this is Mueller quality in the making!

Within this vast array of men and machines, every movement has a purpose... each and every man is thoroughly trained for his work, takes great pride in carrying it to perfection. Each part is carefully examined and tested to insure a product of highest quality and the finest workmanship possible... a product that will give long, safe and trouble-free service.



Never-ending patience and great pride in his work guide this machinist as he manufactures thousands of small parts used in Mueller products.

A skilled workman with a steady hand and a "fire-proof" thumb "wipes" a lead gooseneck joint to mirror-smooth perfection.



Working with extreme care, an experienced craftsman checks each component part of a drilling and tapping machine, insuring trouble-free service, efficient operation for many years.

Extensive testing of the Lub-O-Seal, under the scrutinizing eye of an engineering expert, gives the product a final approval. This Lub-O-Seal lost no efficiency after 1,000 high pressure tests.

Watchful eyes and precision machines combine to complete an exacting cut in a stem that will become an integral part of an ever-dependable Mueller Gate Valve.

Mueller fire hydrants are tested under high pressure to provide proof of the dependability of a product that must always be ready for instant service.

The final test . . .

When the finished unit leaves Mueller Co., the skill, the care and the quality built into each product must meet one final test . . . a test in which Mueller products have demonstrated superior quality time and time again.

This is the test of the product on the job . . . in the line to stay, giving dependable, efficient, long-lasting service . . . a test which proves that the century-old, Mueller tradition of craftsmanship is worthwhile.

MUELLER CO. **DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

MUELLER CO. 100th YEAR SERVING the Water and Gas Industries QUALITY

Since 1857

For lowest cost trenching . . .

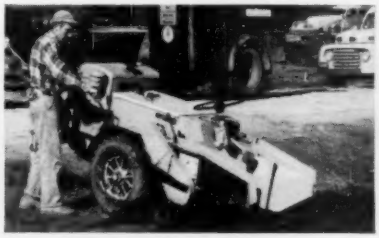
New Model 774 Wheel Ditcher for the big jobs up to 5'6" deep, 30" wide. Ideal for pipeline work. Exclusive Hydra-Crowd allows infinite range of digging speeds to 31 ft. per min. Unique flexible connection between chassis and wheel. Floating differential. All-hydraulic spoil conveyor. Hydraulic controls.

Model 705-B Runabout for scattered jobs up to 4' deep, 10½" wide. 15 m.p.h. road speed. Exclusive vertical boom digs right up to obstructions, leaves no ramp. Hydra-Crowd permits infinitely variable crowding speeds from 0 to 16 ft. per min. Fluid coupling prevents shock loads.

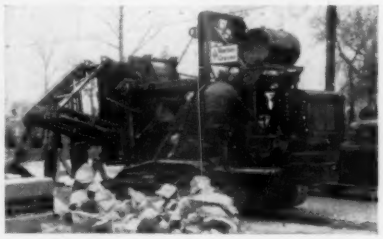
choose the ditcher that's right for you

The first step in reducing ditching costs is to select the machine that meets your requirements. Ground conditions . . . digging range . . . travel speed between jobs—all are factors that change with varying trenching operations. That's why Barber-Greene builds *five* distinctively different ditchers, each with special features that give it unsurpassed performance in its field.

Model 711 for widely scattered jobs. 45 m.p.h. travel speed. Digs to 5' deep and 18" wide. One-man operation. Hydra-Crowd assures maximum crowding speed for every digging condition.



Model 702 for narrow trenches to 5" wide, 40" deep. Ideal for cable, conduit, or small pipe. Easily moved. Varidraulic drive gives finger-tip control of crowding speed from 0 to 20 ft. per min.



Model 44-C for heavy-duty trenching. It cuts to 8'3" deep, 24" wide. 15 digging speeds from 1 to 11 ft. per min., or available with Hydra-Crowd with infinitely variable speeds from 0 to 7 ft. per min.

Literature on request.

57-8-D

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

To order these helpful booklets check the reply card opposite page 78.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Helpful Reference on Swimming Pool Equipment

87. A complete reference catalog of swimming pool supplies, chemicals and equipment is available from Modern Swimming Pool Co., Inc., 1 Holland Ave., Dept. PW, White Plains, N. Y. Detailed information covers filters and accessories, all types of fittings and equipment and helpful suggestions on chemical treatment and pool maintenance. Get your copy of this 52-page book by checking the reply card.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Helpful Booklet on Carryable Centrifugal Pumps

129. A booklet prepared to give practical information that will guide you in choosing the best type of pump for your requirements is offered by the Homelite Corp. Requirements are outlined for many applications. Check the reply card for your copy. Homelite Div. of Textron Inc., 2125 Riverdale Ave., Port Chester, N. Y.

Engineering Data On Gravity Filter Design

170. The complete line of gravity filters and related accessories furnished by the Permutit Co., New York 36, N. Y., is covered in a well-illustrated 24-page booklet. Each element of a filter and filter controls are discussed in detail to assist the designer of these important units. Check the reply card.

Easily Cleaned Long Run Filter Bed Media

70. Bulletins on Anthrafilt tell the reasons why selected, graded crushed anthracite is superior to sand as a filtering material. Have you made a full investigation? Write Anthracite Equipment Corp., Wilkes-Barre, Pa.

All-Electric Floatless Liquid Level Control

174. Description of operating principles and application of B/W controls show the simplicity and many uses of these all-electric, floatless devices. Get latest bulletins for engineering data, diagrams of typical installations and details of component parts. Check the reply card or write B/W Controller Corp., Dept. PW, Birmingham, Mich.

What You Should Know About The Centriline Process

197. The Centriline method for cement mortar lining water mains 16" thru 144" in place to stop leaks, prevent corrosion, increase carrying capacity and decrease pumping costs is fully described in a handsome booklet issued by the Centriline Corp., 140 Cedar St., New York 6, N. Y. Many illustrations and typical case histories show the operation and economies of this process. The Tate process for lining smaller mains is also covered.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Heavy Duty Air Cooled Engines For Many Uses

223. Power and weight specifications, dimensions and uses are fully covered in literature issued by Wisconsin Motors Corp., Milwaukee 46, Wis., on their air-cooled engines. Also available is a service map and a list of their distributors and approved service stations.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

Attractive Bulletin Features Large Elevated Tanks

252. In a 24-page booklet "Horton Elevated Steel Tanks of Large Capacity," Chicago Bridge & Iron Co., Chicago 4, Ill., describes the advantages of using large elevated steel tanks to provide gravity pressure in municipal water systems. Detailed information on radial-cone tanks of 500,000 to 3,000,000-gal. capacity and Hortonspheroidal tanks of 1,000,000 to 3,000,000 gal. is included in this really handsome bulletin. Check reply card for your copy.

Review of Diatomite Filtration of Water

285. A detailed review of the application of diatomite in the general field of water filtration, including uses in municipal supply and swimming pools is contained in a well-prepared 16-page bulletin. Specific applications to certain water treatment problems are also discussed. Write to the Dicalite Division, 612 So. Flower St., Los Angeles 17, Calif. for Bulletin F-552 entitled, "Diatomite Filtration of Potable Water," or check the reply card.

Engineering Data on Pneumatic Ejectors

327. Advantages of Shone Ejectors with details on receivers, check valves, pilot valves, installation and important operation and maintenance features are fully described in three new catalogs covering mechanically controlled types, electrode controlled units and the Expelsor pneumatic ejector. Write Yeomans Brothers Co., 2000-1 N. Ruby St., Melrose Park, Ill.

LOW...

for minimum depth

STRONG...for heavy loads

LO-HED reinforced concrete pipe for culverts and sewers

Elliptical LO-HED Pipe carries a greater flow than its round equivalent in a shallower ditch—has the strength to support tremendous loads. It is easier to lay, to grade and line. LO-HED Pipe features smooth walls and tight joints for maximum hydraulic capacity with less build-up of debris in the invert, even under low-flow conditions. Write for free brochure containing hydraulic characteristics and discharge diagrams on a full range of sizes for nearly all culvert and drainage installations.

Our technical staff will be pleased to assist you with your pipe problems.

FLAT-BASE PIPE

Other uses for under-highway pipe are provided by Flat-Base . . . as an underpass for pedestrians, cattle and conveyances—as utility galleries or industrial tunnels. Write today for illustrated literature.

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101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-5600

To order these helpful booklets check the reply card opposite page 78.

Split Coupling Clamp For Repair of Broken Mains

326. Splice broken mains with a Skinner-Seal split coupling clamp that permanently seals breaks with malleable iron compression rings cast with finger projections and moulded with a soft rubber gasket. Check the reply card or write M. B. Skinner Co., South Bend, Ind. for your description of this clamp.

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 45, Wisconsin.

Points to Consider in Filter Sand Selection

332. Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa. Get full details by checking the reply card.

Dependable Standby Power For Water Pumping

342. The use of LeRoi generator sets for dependable low-cost standby power is discussed in an attractive bulletin, No. G-6, issued by LeRoi Div. Westinghouse Air Brake Co., Milwaukee 14, Wis. Detailed specifications are included. Check the reply card for your copy.

Modern Filtration of Swimming Pool Water

351. Latest data on filtration systems for swimming pools of 50,000 gallon capacity and over is presented in 24-page bulletin No. 625 by R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. Design and operating data are provided, together with material to assist you in choosing the right filter for your pool. Check the reply card.

Diesel Engines For Municipal Power Needs

359. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif. Get latest data by checking the reply card.

Information on Boring Machines

365. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Lube Jack Co., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included. Check the reply card.

How Your Filter Washing Can Be Improved

368. More effective sand washing with elimination of mud balls and bed cracking with resultant longer filter runs are claimed for the Palmer Filter Red Agitator, described in bulletins issued by Palmer Filter Equipment Co., Erie, Pa. Check the reply card.

How to Clean and Develop Water Wells

375. The use of Weltone, which combines the cleaning power of Calgon with disinfecting and other chemicals in a safe, highly soluble powder is described in an interesting and informative booklet. For your copy of this descriptive literature write Calgon, Inc., Hagan Bld., Pittsburgh 30, Pa. or check the reply card.

What You Should Know About Hypochlorination

395. "Hypochlorination of Water" is the name of an informative publication issued by Olin Mathieson Chemical Corp., Industrial Chemicals Div., Baltimore 3, Md. In it there is a discussion of chlorination theory, practice and equipment; control of algae, tastes and odors; and laboratory testing. Check the reply card for this interesting literature.

Book Tells How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet offered by Phelps Dodge Refining Co., 300 Park Ave., New York 22, N. Y. Check the reply card.

Selenium Rectifiers For Cathodic Protection Systems

408. Rectifiers for cathodic protection systems that are designed for easy and rapid installation and that are engineered for minimum attention and maintenance are covered in literature available from Harco Corp., Cathodic Protection Div., Cleveland 28, Ohio. Check the reply card for specifications and operation.

Complete Catalog and Reference Data on Valves and Fittings

422. Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long.

U. S. Tyton Joint Pipe

490. An eight page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids has been announced. The newly developed Tyton Joint is simple, sturdy and tight. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co., Birmingham 2, Ala., or check the reply card.

Bulletin Helps Specify A.W.W.A., Gate Valves

547. Double disc gate valves in 2" to 60" sizes are fully described in a 16-page bulletin which gives details on valve parts, design, materials, application of the "O" Ring Seal, operation and operating devices, directions for ordering valves and parts, dimensions of all sizes, and descriptions of eleven different methods for end connections. Valves for horizontal operation, square bottom valves, many types of gearing and gear cases, and a complete listing of special controls available are included. Get Bulletin A from Rensselaer Valve Co., Troy, N. Y. by checking the reply card.

ROOT-PROOF JOINTS

ORANGEBURG® *Root-Proof* PIPE AND FITTINGS

Independent investigation of Orangeburg Pipe sewer lines, in service up to 50 years, shows that its Taperweld Joints® remain tight . . . against leakage, infiltration, and root penetration.

Orangeburg's record in actual use has earned its recognition as a standard house sewer pipe by leading approving authorities from coast to coast.

OVER 250,000,000 FEET IN SERVICE!

Orangeburg Pipe delivers dependable service because it is strong and resilient . . . withstands temperature changes and traffic tensions . . . resists acids and alkalies in ground waters and sewage wastes. Lines 50 years old, operating like new today, prove its durability.

Orangeburg is easy to install. Lightweight 8-foot lengths handle fast. Taperweld Joints seal root-proof without cement or compounds.

Orangeburg Root-Proof Pipe is for sewer lines from house to street main or septic tank; for downspout run-off lines; storm drains; other non-pressure underground outside lines. Orangeburg also comes *Perforated* for foundation drains, septic tank disposal fields . . . draining wet spots.

For summary of "Report On Investigation of Orangeburg Pipe For Sewers" by a prominent sanitary engineer write Dept. PW-67

ORANGEBURG MANUFACTURING CO., INC.
ORANGEBURG, N. Y. NEWARK, CALIF.

ORANGEBURG ROOT-PROOF FITTINGS

To order these helpful booklets check the reply card opposite page 78.

Cleaning and Relining Water Pipe the Easy Way

397. Complete facilities for relining cast iron or steel water pipe lines in place from 4" to 144" in diameter, with both the Tate process and the Centriline process offered by Pipe Linings, Inc., 2414 E. 223rd St., Wilmington, Calif. For full information on cleaning and relining pipe with only momentary interruption of service, check the reply card.

Important Factors in Water Meter Selection

463. Interchangeability of parts is an important advantage that is yours when you use Trident meters. The newest parts fit your oldest Tridents so you modernize when you repair. Get full data on the entire Trident water meter line by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

Self-Propelled Backhoe For Water and Sewer Departments

470. For virtually every municipal, county and state lifting and digging job, the Bantam self-propelled Model CR-35 is the appropriate machine. It can lift up to 12,000 lbs. and dig up to 100 cu. yds. per hour. For more information write Schield Bantam Co., 234 Park St., Waverly, Iowa, or check the reply card.

Residual Chlorine Recorders For Water Plants and Swimming Pools

508. An instrument for measuring residual chlorine amperometrically in a continuous sample and recording the reading in parts per million on a 24 hour circular chart is described fully in literature available from Wallace & Tiernan Inc., Box 178, Newark, N. J. Check the reply card today.

Data on Mechanical Joint Tapping Valves and Sleeves

605. Eddy mechanical joint tapping valves and sleeves are described in literature available from Eddy Valve. Also described are repair sleeves for cast iron and asbestos cement water mains. Write Eddy Valve Company, Waterford, New York, or circle the reply card for your copy.

"Arctic Boy" Portable Water Coolers

432. Descriptive literature is available on portable water coolers and cans with the Sparkleen Liner. Sizes, models and price lists are fully covered in bulletins from Schlueter Mfg. Co., 4616 N. Broadway, St. Louis 7, Mo. Check the handy reply card.

Water Tanks, Reservoirs and Standpipes

631. Data on steel water tanks, reservoirs and standpipes of all capacities are included in literature available from Graver Tank & Mfg. Co., Inc., East Chicago, Ind. These units are fabricated and erected by the company. Check the reply card.

Self-Priming Centrifugal Pumps For Construction

655. Sizes, capacities, reference tables for selection of the proper pump, performance charts and uses of centrifugal pumps are covered in literature from Barnes Mfg. Co., Mansfield, Ohio. Check the reply card for the latest information on Barnes pumps.

Pollution-Proof Outdoor Drinking Fountain

649. An outdoor drinking fountain so designed that contamination by cross conections or back siphonage is not possible is fully described in a 4-page bulletin. Features neat appearance, easy installation. Write Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati 2, Ohio, or use reply card.

Technical Bulletin on Cushioned Float Valves

666. Golden-Anderson cushioned float valves maintain accurate water level control in elevated tanks, reservoirs, coagulating basins and mixing chambers. Parts lists, dimensions, approximate shipping weights for the various sizes, operation and installation on each of the various types of float valves is contained in a bulletin available from Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 22, Pa. Check the reply card.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included.

Theory of Controlled Digestion With Floating Cover Tanks

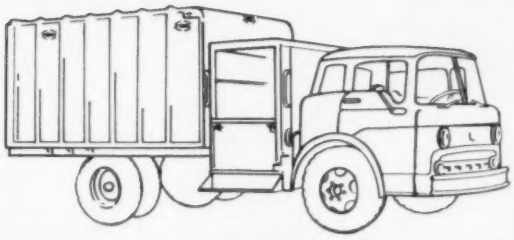
88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers. Requests for this valuable booklet to be made on business letterhead.

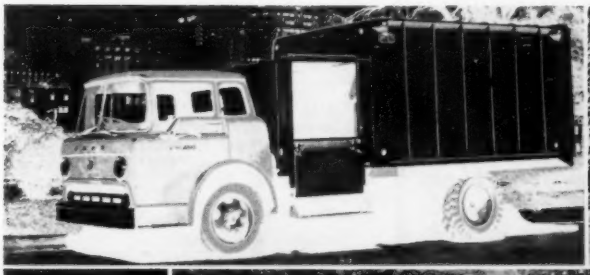
Valuable Information on Water And Waste Treatment Instrumentation

229. Helpful data on pneumatic instrumentation, flow measurement, recording controllers and rapid sand filter control systems are included in a 16-page Bulletin 1-15. Get this from the Foxboro Co., Foxboro, Mass., or by checking the handy reply card.

HYDEPAK

REFUSE COLLECTION BODY





ANY WAY YOU LOOK AT IT, THE BEST BUY IS HYDEPAK

INCREASED CAPACITY . . . Loading capacity is increased up to 50% over similar bodies because 36,000 pounds of hydraulic force are applied to the compressor blade, packing refuse more tightly.

SANITARY . . . HYDEPAK Refuse Collection Bodies are completely enclosed, so that refuse cannot blow off or fall out and odors are carefully confined.

SAFE . . . Easy-to-reach handholds and non-slip safety steps are provided for pick-up men — automatic safeguards to prevent accidents.

SIMPLE OPERATION . . . Three hydraulic cylinders, operated by convenient controls, compress the refuse automatically, and raise the body for quick, clean dumping.

EFFICIENCY IN LESS TIME . . . HYDEPAK loading from either or both sides, unloading at the rear, and bigger loads combine to reduce route-time necessary.

MORE ECONOMICAL . . . Reduced fuel and oil consumption, greater capacity, and dual usage for continuous service, combined to make HYDEPAK Bodies more economical than any other similar refuse body.

FOR INFORMATION WRITE

SOLD THROUGH DISTRIBUTORS

HYDE CORPORATION

P. O. BOX 1265

FORT WORTH, TEXAS

To order these helpful booklets check the reply card opposite page 78.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif., or check the reply card for illustrated folder.

Complete Catalog for Engineers Shows Water and Sewage Plant Equipment

191. The complete line of Jeffrey equipment for treatment of water, sewage and industrial wastes is covered in 64-page Catalog 905. Detailed information is provided on bar screens, grinders, grit collectors, "Jigrit" washers, sludge collectors, feeders, conveyors and other related units. Photos and drawings of installations plus capacity tables complete this valuable booklet. Use card or write Jeffrey Mfg. Co., 947 N. 4th St., Columbus 16, Ohio.

Catalog on Sewage Gas Meters, Regulators and Valves

245. A handy catalog on sewage gas meters, regulators and valves is available from Rockwell Mfg. Co., Pittsburgh 8, Pa. Also included are data on lubricants and accessories, power and remote operation, semi-steel valves and multiport valves. Check the reply card.

Valuable Information on Underground Pumping Stations

246. The complete prefabricated underground pumping station is fully described in a bulletin just released by Zimmer & Francescon, 1715 Fifteenth Street Place, Moline, Ill. Construction features, corrosion control, electric controls, specifications, pumping equipment and installation are a few of the items covered. Check the reply card.

Data Offered on Water, Sewage and Waste Treatment Equipment

263. Equipment for sewage treatment, water purification and industrial waste treatment is described in a 16-page Book No. 2440, published by Link-Belt Co., Colmar, Pa. Case histories, photographs and schematic drawings are included. Straightline and Circuline collectors, Thru-Clean and Straightline bar screens, Tritor screens, flash mixers, scum breakers and other units are described.

How and Where to Install A Septic Tank System

270. A manual on modern sewage disposal methods for individual dwellings, camps and rural schools has been released by Brown Co., 150 Causeway St., Boston, Mass. Location, size of and building the tank, how large a disposal field and laying out the field are discussed. Check the reply card today.

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, side suction centrifugal pumps and mixed flow pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., Loucks at Dearborn, Aurora, Ill. Included is a pump selection guide. Check the reply card.

Combat Unpleasant Odors At Municipal Sanitation Sites

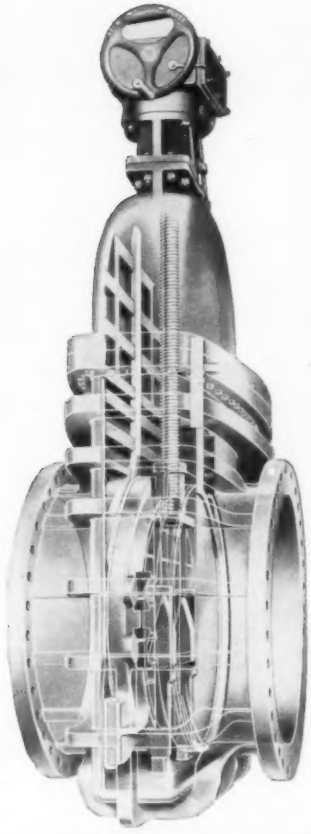
404. Malodors at municipal refuse disposal sites, waste treatment plants and incinerators may be effectively "neutralized" by the odor masking products of Rhodia, Inc. Be sure to investigate this means of eliminating complaints from unpleasant odors. Write Rhodia, Inc., 60 East 56th St., New York 17, N. Y. or check the reply card.

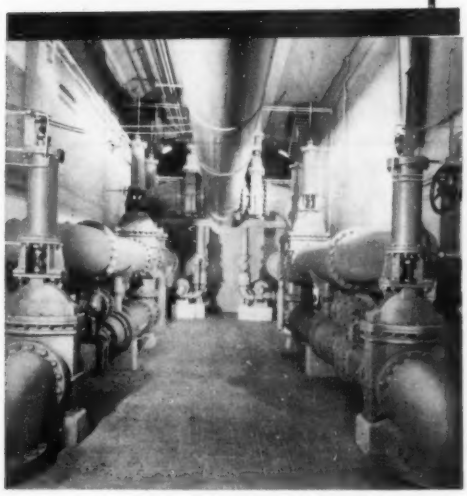
Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 102 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

Raw Sewage and Sludge Pump Catalog

626. Specifications, graphs on the determination of pump sizes, and illustrated photos of pumps are included in catalog from Chicago Pump Co., Sewage Equipment Div., 622 Diversey Parkway, Chicago 14, Ill. Check the reply card.





RENSSELAER

SQUARE BOTTOM VALVES

The Rensselaer Square Bottom Valve may well be called the "work horse" of the valve family. It is built to stand up under the severe conditions found in automatic operation, throttling, differential pressures and the constant opening and closing found in filtration plants and process industries.

A three-point gate support holds the downstream gate away from its seat ring at all points of travel except the final, fully closed position. Any tendency for the downstream gate to tilt and score the face of the seat ring under conditions of high water velocity or throttling service is eliminated.

At all points this valve is built for long life under constant and severe operation.

IN OPENING: the shoes slide up the stainless steel track inclines to the higher level of the tracks, lifting the gate clear of the bronze seat ring.

IN CLOSING: the gate does not come in contact with the bronze seat ring until the closing point is reached. Even when partly open, the gate is held away from the seat, eliminating all wear due to vibration.

Rensselaer Square Bottom Valves are made in sizes from 4 to 48" with any type end connection. By-passes, spur or bevel gearing, and cylinder or motor operation as desired. 20

Ask for Bulletin "E"

LUDLOW & Rensselaer

LUDLOW RENSSELAER **VALVES & HYDRANTS**

Since 1861 **THE LUDLOW VALVE MANUFACTURING CO.** *Troy, N. Y.*

To order these helpful booklets check the reply card opposite page 78.

Butterfly Valves For Water and Sewage Treatment Plants

507. Rubber seated butterfly valves are described and illustratrd in a new two-color Bulletin No. 5603, available from F. B. Leopold Co., Inc., 227 So. Division St., Zelienople, Pa. Complete details on the performance and construction features of the valve are included.

Dorr-Oliver Equipment & Methods For Modern Sewage Treatment

494. This 12-page, two-color bulletin describes the characteristics, types, sizes, applications and operation of Dorr-Oliver sewage treatment equipment and presents a number of typical plant flowsheets. Also included are photographs and line and wash drawings of various units. Copies are available from Dorr-Oliver Inc., Barry Place, Stamford, Conn.

Controls For Use in Pumping Stations and Sewage Plants

662. Single and multi-pump sump controls, pressure operated for use in pumping stations and sewage disposal plants are described in literature available from Healy-Ruff Co., Water Level Controls Div., 2255 University Ave., St. Paul 14, Minn. The two principal types of pressure operated sump controls are covered along with general descriptions and features. Check the reply card.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipe, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

Clean Sewers With the O'Brien Sewerking

678. The O'Brien Sewerking operates completely by power in cleaning sewers and for full information write O'Brien Mfg. Corp., 5662 Northwest Highway, Chicago 30, Ill. Check the reply card to find out how power rotates cable and cutting tool and how power transmission drives cable forward or reverse.

CONSTRUCTION EQUIPMENT AND MATERIALS

How to Get Better Concrete Construction

93. A report on the use of "Pozzolith" as a means of increasing the strength and durability and reducing the permeability of concrete structures, while reducing costs at the same time, is presented by Master Builders Co., Cleveland 3, Ohio. Check the reply card today.

Get Data Now on This Catch Basin Cleaner

198. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit, Netco Div., Clarke Wilcox Co., 118 Western Ave., Boston 34, Mass. Check the reply card.

Complete Line of Concrete Gunning Equipment

208. A 16-page catalog that gives complete details, specifications and operating capacities of concrete gunning equipment and answers to many of the questions asked about air placed or gunned concrete is available from Air Placement Equipment Co., 1009-11 West 24th Street, Kansas City 8, Mo. Also included are several pages of actual job application photographs showing the many and varied uses of this modern equipment.

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air. For full details check the reply card.

Portable Melting Furnace For Rubberized Joint Sealers

357. The Hauck double jacketed melting furnaces use L-P as a fuel and high flash point oil for heat transfer to assure close temperature control when melting rubberized joint sealers of all types. All details on this 16-gallon capacity unit are furnished in Bulletin 1081. Check reply card for your copy. Hauck Mfg. Co., 124 10th St., Brooklyn 15, N. Y.

Go-Anywhere Transportation Provided by the "Jeep" Family

377. A new booklet which graphically portrays the wide range of uses of "Jeep" vehicles in public service is now available from Willys Motors, Inc., Toledo 1, Ohio. Specifications, special equipment, accessories and plenty of photographs of the jeep in action are included. Just check the coupon for your copy.

Restoration and Protection Of Concrete Structures

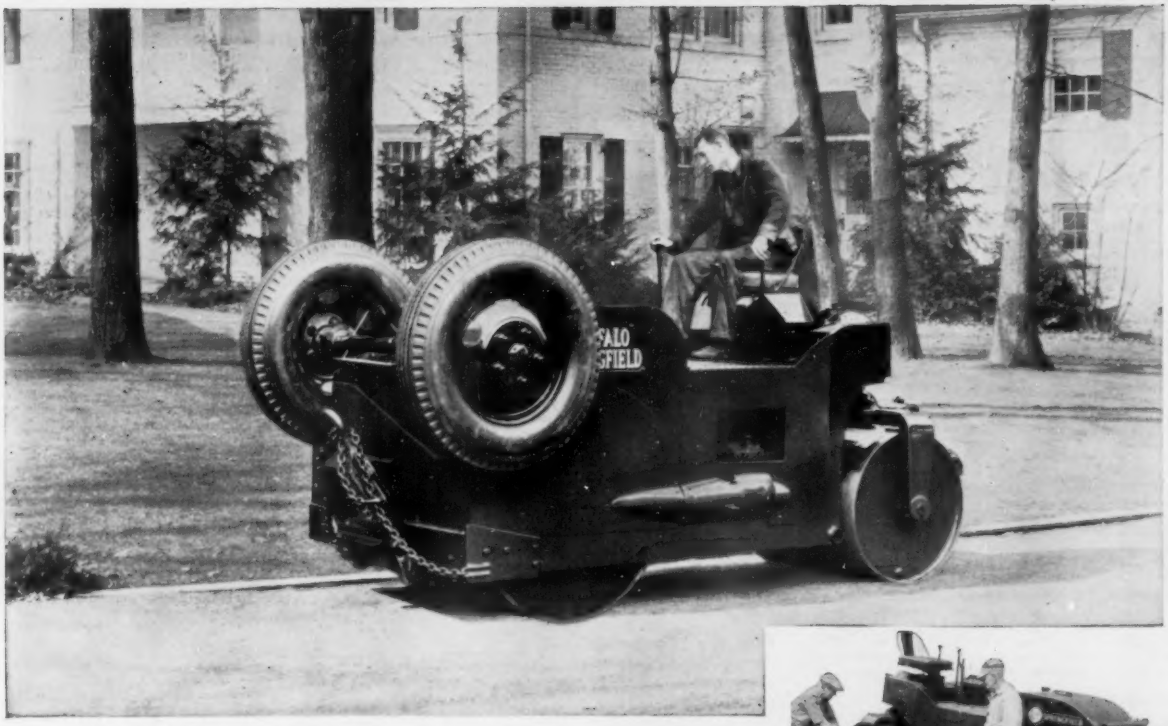
385. A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication.

IHC Crawler Tractors For Highway Construction

491. Information on the new International TD-6, TD-9, TD-14 and TD-18 diesel crawler tractors is contained in 8-page, 2-color booklets available from Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Mechanical features and specifications, engine power, and operation are fully covered.

Tracto-Loaders For Fast Material Handling and Excavating

600. Tracto-Loaders with capacities from ¼ cu. yd. to 1½ cu. yd. are described fully, in a 2-color catalog available from Tractomotive Corp., Deerfield, Ill. General purpose material handling and excavating loading in confined areas are jobs performed by these machines. Check the reply card.



The Roller is easily rigged for towing. Inclined wooden blocks are provided for raising guide roll to slip on road wheels and pin them in place.

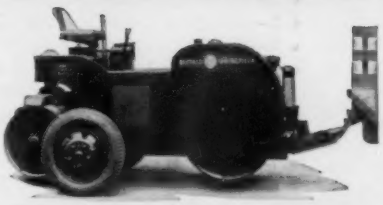
For heavy-duty rolling *PLUS PORTABILITY...use this* BUFFALO-SPRINGFIELD Roller

A conventional heavy-duty roller in construction and performance, this 3-5 ton Tandem Roller, when equipped with the Towing Attachment*, is easily transported from job to job. All essential design features of the larger Buffalo-Springfield tandems, *plus portability,* make this particular roller especially popular for handling a large variety of smaller rolling jobs.

Driveways, sidewalks, parking and playground areas, patching and light finishing work are finished fast . . . and the Portable roller is ready for new work at a different location, with minimum time lost.

Rubber tired road wheels are carried out of the way, on a bracket over the drive roll. When the roller is working, there are no tire treads to mar surface materials or produce uneven surface compaction. For heavy-duty roller performance, plus the economy of using *one* roller quickly at scattered locations, get a Buffalo-Springfield *Portable* Tandem Roller.

See your Buffalo-Springfield distributor now, or write for Bulletin S-58-49 for complete details.



Towing hitch is quickly engaged with pintle on towing vehicle. Hand-operated hydraulic jack installed as part of the towing attachment is employed to raise the drive roll off ground.

*Towing Attachment is available as optional equipment.

BUFFALO-SPRINGFIELD ROLLER CO.
DIVISION OF KOEHRING COMPANY · SPRINGFIELD, OHIO

To order these helpful booklets check the reply card opposite page 78.

One Man Field Tool
Machines Any A-C Profile

475. Literature is available from Spring Load Mfg. Corp., 3610-D First Ave., South, Seattle 4, Wash., describing the Model B Spring Load A-C machinery and tapering tool. Also information on Spring Load A-C pipe cutters are included. Check the reply card.

A Completely
Hydraulic Ladder

610. This completely hydraulic ladder is described in a new catalog published by J. H. Holan Corp., 4100 West 150th St., Cleveland 11, Ohio. Detailed drawing of the pedestals, throttle control and ladder construction are included. Check the reply card today.

Construction Guide
For Engineers and Builders

669. A 34-page four sectioned construction guide containing full-page structural drawings that provide basic information on types, grades and applications of fir plywood for engineers and builders has been released by Douglas Fir Plywood Association, Tacoma 2, Wash. Check the reply card for data on floor construction, single and double wall construction and roof construction.

Use The Reply Card

Tilting Side Discharge
3½-Cu. Ft. Concrete Mixer

632. A 4-page catalog describing the 3½-cu. ft. concrete mixer has been released by Kwik-Mix Co., Port Washington, Wisc. The well illustrated catalog covers structural and operational features. Check the reply card.

What You Should
Know About a Motor Grader

673. Photographs, sketches and other instruction illustrations aid readers to visualize details of the Allis-Chalmers Model Forty-Five motor grader mechanical features and components. The catalog also tells about attachments and accessories. Write Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wisc.

Paints For Bridges, Water
Tanks & Other Metal Structures

624. Flake silica graphite paints for outdoor metals are described fully in literature from Paint Sales Div., Joseph Dixon Crucible Co., Jersey City 3, N. J. Check the reply card for details on these primer and protective paints.

Catalog on Road
Rollers and Compaction Equipment

667. Two and 3-axle tandem rollers, 3-wheel variable weight rollers and the Kompactor are covered in this catalog from Buffalo-Springfield Roller Co., Springfield, Ohio. Specifications, models and features are included. Check the reply card today.

●

STREETS AND HIGHWAYS

How to Save Time on
Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving setups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept. PW, Warren, Ohio. Use the reply card to get your copy.

How the "Payloader"
Helps Public Officials

190. An attractive booklet "Getting More for the Tax Dollar with Payloaders" makes worthwhile reading for every public official in charge of construction and maintenance of roads, streets, and utilities. You will find illustrations and data showing dozens of ways the "Payloader" is used by cities, counties and states, plus convenient specifications on seven models. Check the reply card or write Frank G. Hough Co., 761 Seventh St., Libertyville, Ill.

Trenching Equipment Data
Conveniently Assembled

212. The entire line of Cleveland trenching and backfilling equipment is now covered in a single bulletin, with material arranged for quick comparison of capacities, specifications and dimensions of all models. Twenty-four action photos graphically illustrate various job applications. Get Bulletin S-120 now for easy review of your trenching equipment needs. Just check the reply card or write to the Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

How to Solve the
Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass.

How "Gradall" Applications
Meet Your Job Needs

310. A new, profusely illustrated bulletin showing Gradall machines at work on a wide variety of municipal, county, township and highway maintenance and construction jobs has been issued by the Gradall Div., Warner & Swasey Co., Cleveland 3, Ohio. Production figures are provided to show the work output of this machine on all sorts of applications. Get your copy by checking the reply card. It's a convenient review of the many ways you could use a Gradall machine.

How to Design Stabilized Bases
Using Bitumuls Emulsified Asphalt

379. "Bitumuls for Base Construction" is the title of a 12-page booklet discussing the use of Bitumuls emulsified asphalt for this phase of pavement construction. Step-by-step outline covers laboratory tests of soils. Bitumul quantity requirements, construction procedures and advantages. Your copy is available. Write to American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 20, Calif., or check the reply card.

This NEW FOX SPREADER

MOUNTED ON YOUR TRUCK

Spreads 35 tons or more of sand and chips in 9 hours

... attached or removed from truck in 15 minutes

No need to buy extra trucks to use this new FOX sand, chip, calcium chloride spreader. In 15 minutes the FOX can be mounted, firmly anchored in place on a dump truck body—and ready to load. When sanding is completed the spreader can be removed and the truck released.

You don't have to back up slippery hills with a FOX . . . for the Fox throws an even layer of abrasive material in front of rear wheels as well as behind them. This past winter 12 miles of steep hills were regularly sanded in 1½ hours with a FOX. Formerly 4 hours were required.

One man handles the entire operation. With the Fox there's no need to slow down the truck to start and stop the flow of materials—width of spread changed from 8' to 32' with handy lever. It's all regulated from the driver's cab . . . operating effectively at speeds from 5 to 40 miles per hour.

You lose less time reloading, with the FOX. Accurate case-history figures show that a FOX load (5 yards)*covers nearly twice as much area as most spreaders. The amount of material used for effective sanding on hills, streets, highways and intersections is thus reduced by approximately one-half.
*Also available in larger sizes.

More than 300 hours of operation with no time out for repair. That's the accurate record made by the city of Appleton, Wisc. last winter. Patented *auger feed,* mounted on Timken bearings insures even, steady flow of material to powerful spinner. No conveyor chains or drag bars to wear, rust or break.

Back of the NEW FOX SPREADER are 28 years' experience building extra-sturdy, extra-dependable multi-purpose equipment, that has always challenged comparison. Your Fox road machinery dealer can give you much more information, prices and complete specifications. If a dealer has not been appointed in your locality write, wire or phone collect to *Fox River Tractor Co., Dept. R3, P.O. Box 469, Appleton, Wisconsin. Phone: REgent 4-1451.*

FOR MORE DETAILS **Fox River Tractor Co., Dept. R3 Appleton, Wisconsin**

I'm interested in making a substantial savings in our sanding operations. Please send complete specifications, performance records and prices on the new Fox Sand Spreader.

Name_____

Position_____

Address_____

City_____ State_____

FOX RIVER TRACTOR CO.
APPLETON, WISCONSIN

To order these helpful booklets check the reply card opposite page 78.

Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, all purpose line markers, and hand-propelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy reply card.

Cut Road Building Costs With A Tamping-Leveling-Finisher

175. For a full description of roadbuilding methods with a tamping-leveling-finisher which lays a smooth mat without forms, tamping and compacting to desired grade, get Bulletin 879-A from Barber-Greene Co., Aurora, Ill. Check the reply card today.

Information on Open Steel Mesh For Britges

337. A 28-page catalog on open steel mesh pavement for bridges is available from Irving Subway Grating Co., Inc., 50-53 27th St., Long Island City 1, N. Y. Design data, construction and maintenance procedures and where the decking can be used are fully covered.

Literature on Asphalt and Aggregate Spreaders

431. Aggregate and asphalt spreaders are fully described in literature available from Good Roads Machinery Corp., Minerva, Ohio. The "Odell" and "Handy" speakers can be hitched to any standard dump truck and can spread asphalt, gravel, clay, limestone for highway construction and maintenance. For full details check the reply card.

Valuable Information On Aerial Surveys

437. What you should know about aerial surveys is described in detail in the latest literature just released by Alster and Associates. 6135 Kansas Ave., Northeast, Washington 11, D. C. Topographic maps, mosaics and planimetric maps by aerial photograph are fully illustrated. For more information check the reply card.

Information on 5 Versatile Tractors For Municipal and County Work

484. Tractors that find scores of highly efficient applications in construction, municipalities, utilities and related fields are described fully in a catalog just released by Massey-Harris-Ferguson, Inc., Industrial Div., Quality Ave., Racine, Wisc. Models, specifications, attachments and uses are covered.

3-Way Ditcher-Terracing Blades

488. Servis heavy duty and standard 3-way ditcher-terracing blades with scarifier teeth, grader wheels and end plates for conversion to a leveling scraper are described in bulletin available from Servis Equipment Co., 1000 Singleton Blvd., Dallas 21, Texas. Check the reply card for specifications, design and application.

Better Traffic Signs By Using Plyglaze Overlaid Plywood

496. Plyglaze high density overlaid plywood requires no protective paint coating when used for traffic control signs. The plyglaze surface provides an ideal base for permanent weatherproof bonding, and it will not check, blister or deteriorate when marred by bullet holes. For further information write St. Paul & Tacoma Lumber Co., Dept. P.W., Tacoma 1, Wash., or check the reply card.

Survey Marking and Identification Equipment

601. Surveyor stakes, identification caps and monument markers are described fully in literature available from Bathey Mfg. Co., Plymouth, Mich. Price schedules and descriptions are included. Check the reply card today.

Hydrocrane Used As A Backhoe, Crane or Clamshell

606. When your work calls for lifting, digging and trenching all in the same day you need a machine that converts from crane to clamshell to hoe quickly and easily. Check the reply card or write Bucyrus Erie, South Milwaukee, Wisc. for information on the Hydrocrane.

Literature on 1957 Chevrolet Utility and Maintenance Trucks

579. Light and medium duty 1957 Chevrolet trucks are described fully in literature available from Chevrolet Div. of General Motors, Detroit 2, Mich. New features include modern versions of Thriftmaster and Jobmaster 6's and the short-stroke Trademaster V8's and the 283 cu. in. Taskmaster V8's. Also optional features are the Hydra-Matic and Powermatic transmissions. Check the reply card.

Vacuum Cleaner and Leaf Collector For Cleaner Streets

595. A unit is now available that can be mounted on a right-hand drive jeep or a pick-up truck for picking up gutter trash and leaves. Complete specifications, capacity, operation and installation procedures are covered in a bulletin available from Tarrant Mfg. Co., Saratoga Springs, N. Y., or can be obtained by checking the reply card.

Construction Methods for Salt Stabilized Roads

609. A comprehensive booklet showing modern methods of salt stabilization is available from the Morton Salt Co., 120 So. LaSalle St., Chicago 3, Ill. Stabilized secondary roads, base courses and shoulders are discussed and all equipment and construction methods are covered. Just check the reply card for your copy.

Fifty Combinations of Matching Equipment For Case-Terra Trac Tractors

617. Dump loaders, angledozers, bulldozer blader, backhoes, mowers and scarifiers are several of the attachments available for the 40 to 100 hp Case-Terra Trac crawlers and industrial wheel tractors. For complete information on the attachments and tractors write J. I. Case Co., Racine, Wisc., or check the reply card.

Warn Lock-O-Matic Hubs Manual

618. Warn Hubs make 4-wheel drive more useful, because they make it into a "free-wheeling" 2-wheel drive, as well as a 4-wheel drive. The Lock-O-matic hubs reduce front end wear, engine load and gear whine. Check the reply card or write Warn Mfg. Co., Riverton Box 6064, Seattle 88, Wash.

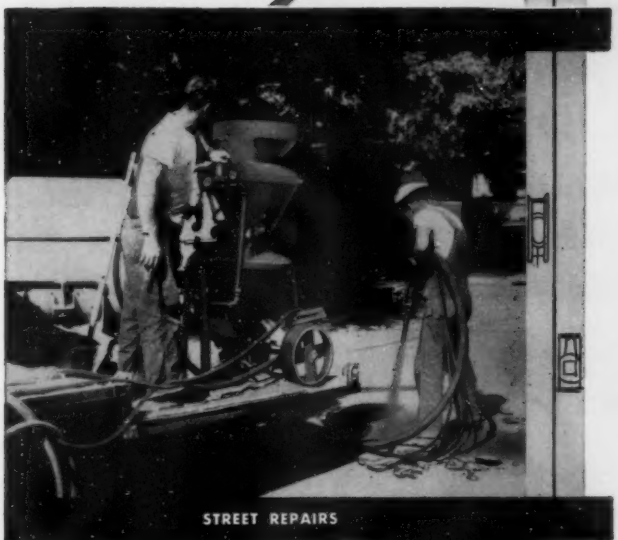
THE AIRPLACO PORTABLE RIG — consists of NUCRETOR or BONDACTOR, MIX-ELVATOR and SAND-LOADER and can be hitched onto a pickup or compressor truck for maximum portability.

Here's the Equipment that's *Streamlining* Street and Curb Repairs...

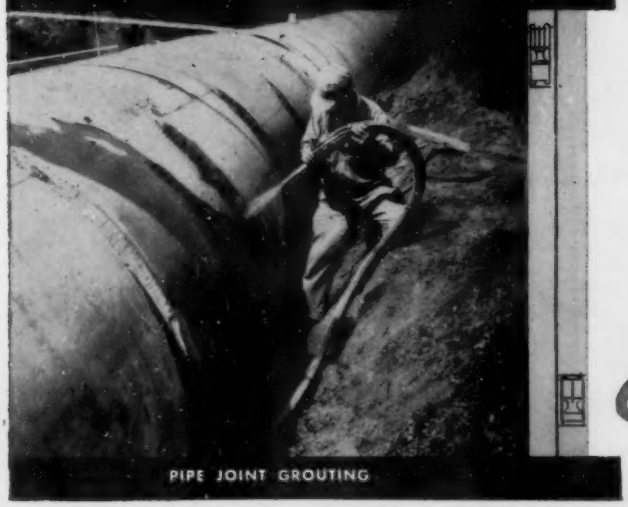
...and lowering the cost!

The AIRPLACO®

PORTABLE CONCRETE GUNNING RIG



STREET REPAIRS



PIPE JOINT GROUTING

Whether you are repairing curbing, streets, sidewalks, bridge abutments, reservoirs or doing any other type of concrete repair or restoration, the job will go much faster . . . much smoother . . . and at a big savings when you put the new AIRPLACO Portable Rig to work.

The AIRPLACO Portable Rig combines efficiency, portability and adaptability all into one unit. It can be moved quickly and easily from one job site to another. Operation is fast with the AIRPLACO SAND-LOADER and MIX-ELVATOR working together loading materials into the AIRPLACO BONDACTOR* or NUCRETOR.* And what could be more efficient than to gun your concrete with any one of the AIRPLACO BONDACTORS or NUCRETORS?

AIRPLACO concrete gunning equipment is available in a wide range of sizes to fit your production and job requirements from ½ to 7 cubic yards of aggregate per hour, and using air compressors with 75 to 600 CFM capacity.

*Registered Trade Name

FREE CATALOG!

See your AIRPLACO distributor or write today for your complimentary catalog of AIRPLACO Concrete Gunning Equipment. This catalog will answer many of your questions about this modern, efficient equipment.

AIRPLACO® **AIR PLACEMENT EQUIPMENT CO.**

1013 WEST 24TH ST. KANSAS CITY 8, MO.

MANUFACTURERS OF ADVANCED DESIGN CONCRETE GUNNING, MIXING, GROUTING AND SANDBLASTING EQUIPMENT

Equipment For Highway Stabilization

363. The Roto-Mixer and Preparator are machines available for low-cost road building and stabilization. For operation uses and specifications get literature from Road Machinery Div., Bros. Inc., Minneapolis 14, Minn., or check the handy reply card.

Spreading Equipment For Ice Control

543. An ice control catalog describing the full line of Baughman ice control spreading equipment has been released by Baughman Mfg. Co., Jerseyville, Ill. Included are illustrations and descriptions of truck-mounted spreader bodies, tail gate spreaders, dump body and pull type spreaders and gravity feed spreaders. For your copy of this helpful and interesting booklet check the reply card today.

Light Duty Trucks For Construction and Maintenance

628. Pickup and stake body trucks are fully described in literature from Ford Div., of Ford Motor Co., Dearborn, Mich. Pickups are available in 6½, 8 and 9-ft. lengths. They come in standard colors and with either a 6 or V-8 engine. Rigid tailgate and steel corner posts add to the over-all body strength. The stake body trucks come in 6½, 7½ and 9-ft lengths. These units also come in 6 or V-8 engines. Check the reply card for full information.

Grass and Weed Trimmer-Cutter Attachment

671. A one-man, portable grass and weed trimmer and cutter attachment is described in literature from Roweo Mfg. Co., 89 Emerald Street, Keene, N. H. The unit eliminates hand clipping or scything for highway maintenance and parks. Check the reply card.

Post Hole Digger With Interchangeable Heads

677. Post hole digger for installing guard rail, sign and similar posts is described in literature from Roper Mfg. Co., Zanesville, Ohio. The digger is equipped with a series of interchangeable heads for a wide range of uses from penetrating soft earth to perma-frost shale and coral rock. Check the reply card today.

Sand, Chip and Calcium Chloride Spreader For Ice Control

683. Complete specifications, performance records and prices on the Fox sand spreader are covered in literature from Fox River Tractor Co., Dept. R3, P. O. Box 469, Appleton, Wisc. Spreader can be attached or removed from most any dump truck in 15 minutes and can be operated from 5 to 40 miles per hour. Check the reply card.

•

STREET LIGHTING AND TRAFFIC CONTROL

Engineering Data on Aluminum Lighting Standards

256. Latest designs and applications of all-aluminum, seamless, tapered lighting standards, traffic signal posts and elliptical lighting brackets plus detail drawings and mechanical specifications are provided in a comprehensive 16-page bulletin issued by Pfaff & Kendall, 84 Foundry St., Newark, N. J.

Traffic System Computer & Selector

260. Electro-Matic Master Equipment is fully covered in Bulletin E-222 just released by Automatic Signal Div., Eastern Industries, Inc., Norwalk, Conn. This system provides coordinated signal control responsive to traffic changes as they develop and it continually evaluates and adjusts to volume and direction of traffic.

Engineering Guide to Mercury Street Lighting

380. Basic engineering aspects of mercury vapor street lighting are discussed in a 35-page Engineering Guide available from Westinghouse Corp., Box 2099, Pittsburgh 30, Pa. This practical reference includes technical data on mercury lamps applicable to general lighting service, operating characteristics of the system and a discussion of methods of economic evaluation of alternative lighting systems.

(Continued on page 64)

Now.... FROM GAR WOOD

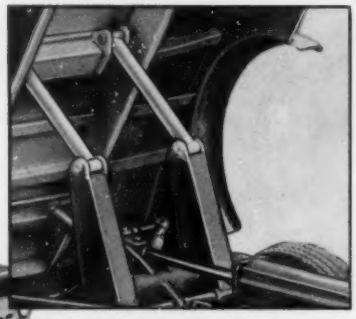
THE REVOLUTIONARY CYCLOMATIC

LOAD-PACKER® 500

- BIG YARD-AND-A-HALF HOPPER!
- START RELOADING IN 4 SECONDS!
- PACKS UP TO 25% GREATER PAYLOADS!

Another historic "first" by Gar Wood...the most famous name in refuse-collection equipment!

Highest Dumping Angle...
Fastest Clean-Out!



GREATER DUMPING STABILITY
Famous Gar Wood twin-arm hoist gives you maximum stability for dumping on soft landfill operations. Lift arms are anchored together, move as a unit to exert equal lifting force, and provide unmatched stability. Dumping is fast, smooth and safe. Hoist has reserve capacity to handle your biggest loads... no booster hoist needed... greatest efficiency.

The new LOAD-PACKER *500* has the highest dumping angle of any refuse-collection body on the market. This means faster, cleaner discharge of tightly compacted loads. Smooth, tapered interior also insures fast, complete dumping... no wheel wells to slow clean-out.

THE Gar Wood LOAD-PACKER® 500

SIX WAYS YOUR BEST COLLECTION EQUIPMENT VALUE

1 **SIMPLE, FUNCTIONAL DESIGN**—New Cyclomatic principle has fewer moving parts, less linkage. Fewer adjustments to make. All working parts easily accessible for maintenance.

2 **OUTSTANDING FUEL ECONOMY**—Operation at high engine r.p.m. is reduced up to 250% because of exclusive 10-second cycle. Most economical refuse-collection unit ever built.

3 **PRODUCTIVE TIME INCREASED**—Bigger loads, faster cycles result in increased efficiency. Maintains collection schedules... more pick-ups per load... and less manpower fatigue.

4 **LOWER MAINTENANCE COSTS**—Big 1½ cubic yard hopper cuts number of packing cycles per day; each cycle takes only 10 seconds. Assures longer life.

5 **BUILT FOR SAFE OPERATION**—Glide-away hopper closure seals hopper for travel to and from disposal point. Riding steps are skid-proofed for crew safety. Two men can ride on curb-side of unit.

6 **UNMATCHED DISTRIBUTOR SERVICE**—No other manufacturer can match Gar Wood's worldwide field organization for years of truck equipment experience, prompt parts delivery, and factory-trained service personnel.

THE LOAD-PACKER 500

...YEARS AHEAD IN DESIGN AND ENGINEERING!

★ All working parts fully protected from damaging contact with refuse.

★ Big-bore cylinders deliver more power with less travel and friction.

★ Hydraulic cylinders operate at lower pressures . . . less strain on hydraulic system.

★ Dual side doors are standard equipment on all Load-Packers.

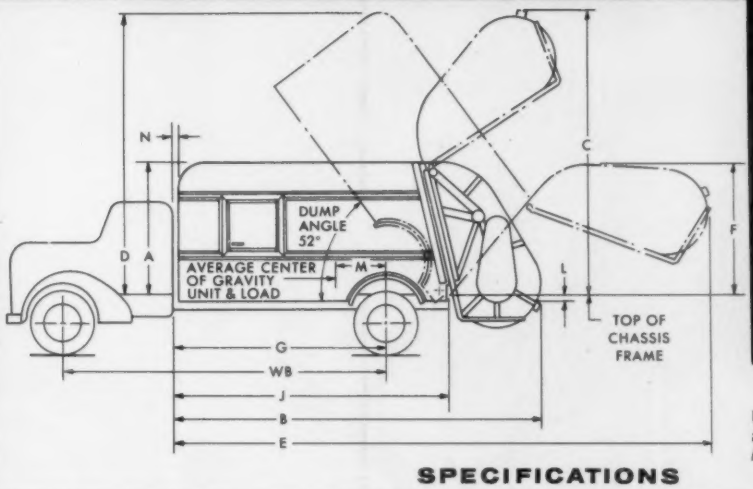
★ Cyclomatic rotary and packing panels can be stopped or reversed at any point in the cycle.

★ All-welded body for leak-and-odor-proof operation. Double-rubber gaskets in tail gate provide positive sealing to body.

★ Self-dumping sanitary containers speed handling at big-volume stops.

★ 10, 13, 16 and 20 cubic-yard capacities . . . a body size for every need.

★ Longer life for power-take-off and transmission case assured by exclusive Gar Wood dual-volume pump operating at 23 and 27 gallons per minute. Reduces transmission horsepower requirements.



Every day you use it, every year you own it, you'll find the LOAD-PACKER *500* the most efficient unit ever built!

GENERAL NOTE:
Unit weight includes body—hoist—subframe and drive—including attaching parts and oil. All weights estimated.

SPECIFICATIONS

MODEL	RATED CAPACITY	A	B	C	D	E	F	G		OVERALL WIDTH	UNIT WEIGHT	J	*K	L	M		N	
								*	**						*	**	*	**
LP-510	10 CU. YDS.	74	174	165	129	266	78	84	—	95½	8730	118	7170	4	15	—	3	—
LP-513	13 CU. YDS.	74	192	165	142	284	78	102	84	95½	8970	136	7360	4	23	5	3	3
LP-516	16 CU. YDS.	81½	198	176½	148	305	80	102	102	95½	9570	137	7790	4	19	16	3	6
LP-520	20 CU. YDS.	82½	234½	177½	178	342	80½	135	131	95½	10770	174	8750	4	29	25	3 7/16	3 7/16

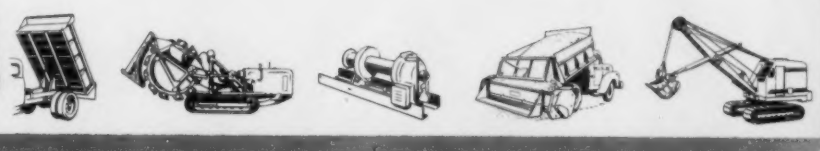
* SINGLE AXLE ** TANDEM AXLE *K—weight of body and tail gate only.

GAR WOOD INDUSTRIES, INC.

Wayne, Michigan • Richmond, California

Plants in Wayne, and Ypsilanti, Michigan; Findlay, Ohio; Mattoon, Illinois; Richmond, California

GarWood



Hoists & Bodies Ditchers Winches Spreaders Excavators

Form W-210 - 5-57 Litho In U. S. A.

Up to 25% greater loads with the

LOAD-PACKER® 500

LOW, WIDE HOPPER CLEARED FASTER THAN TWO MEN CAN LOAD IT!

Here's the first completely new design since Gar Wood introduced packing-type collection equipment! For the first time on any unit, packing panel is designed only to pack . . . rotary panel is designed only to clean hopper. The result is faster loading and greater compaction. In competitive tests conducted by Sanitary Departments in major cities, the LOAD-PACKER *500* has delivered up to 25% greater loads.

BIGGER HOPPER

LOWER LOADING HEIGHT

FEWER CYCLES

NOW YOU CAN LOAD MORE REFUSE FASTER AND EASIER...MAKE MORE PICK-UPS BETWEEN PACKING CYCLES...WITH THE

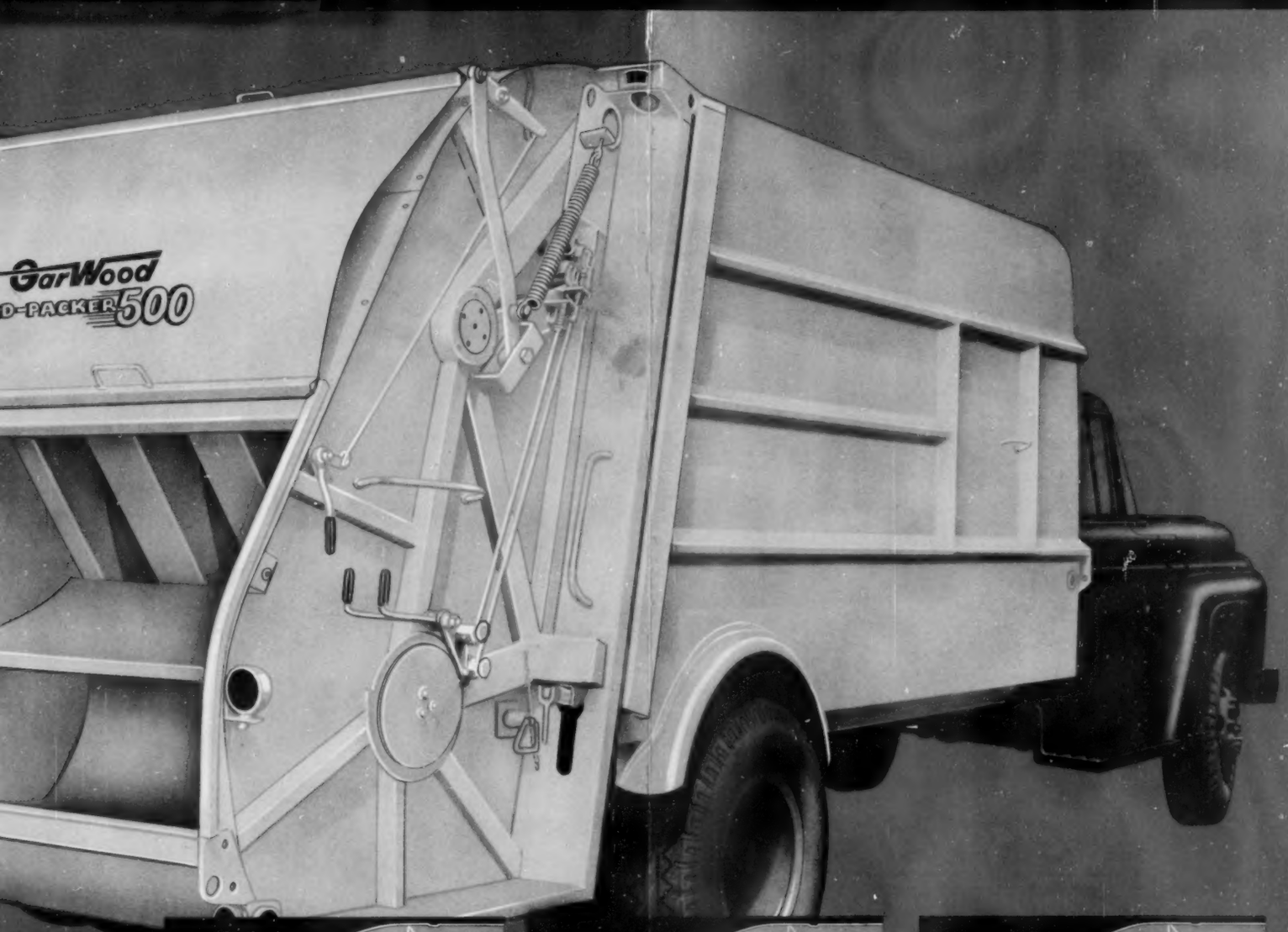
LOAD-PACKER® 500

- 20% more hopper capacity than any other rear-loading unit
- Lower loading height—4 inches below truck frame in every body size
- Widest hopper opening on the market—a full 75 inches lets *three* men load side-by-side
- Non-selective loading — no delays to crush large objects, assures complete collection service
- Unlimited overhead loading clearance—speeds up emptying of large containers

Revolutionar

CYCLOMATIC PACKING

New rotary panel plus direct-th compaction at floor level means fa cycles...produces up to 25% bigger loads, by official competitive tests!



NEW GLIDE-AWAY
To seal hopper, just touc
quietly and quickly into
in closed position for tr
Door glides easily to o
automatically locked. C
functional styling of the
Here's a unit that will b
your community for all th

mary

ATIC
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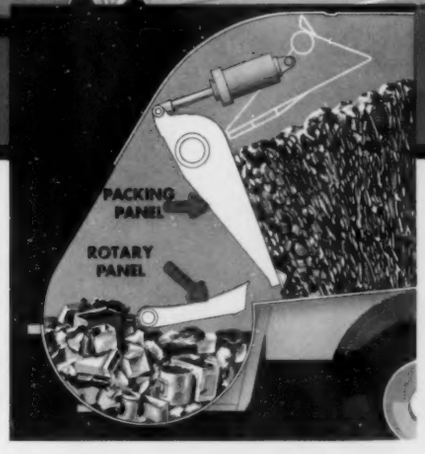
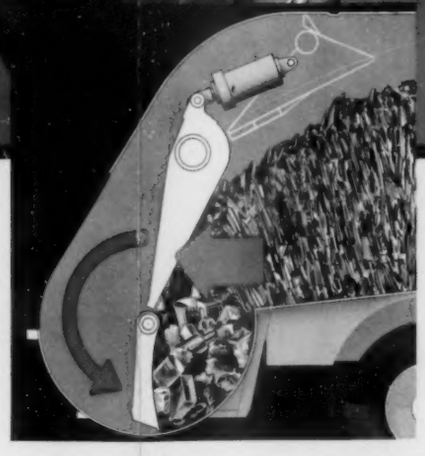
direct-thrust
means fastest
bigger pay-
tests!



HOPPER CLEARED INSTANTLY — Trip the Cyclomatic starter, and rotary panel revolves full 360 degrees, forcing refuse up to body level. No waiting for packing plate or hopper to move into position. Unlike other units, materials cannot be swept back into the street.

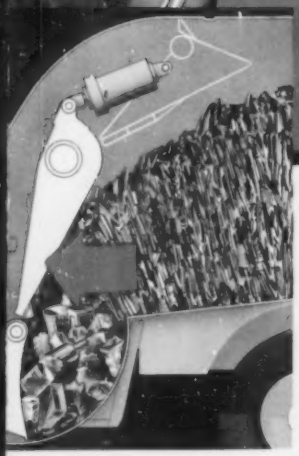


START RELOADING IN 4 SECONDS — 1½-yard hopper cleared for re-loading in just 4 seconds after cycle starts. This combination of fast cycle and large hopper results in faster loading than ever before. As rotary panel reaches bottom of hopper, packing panel moves to thrust position.

UP TO 25% BIGGER LOADS — Full-width packing panel, powered by dual 7-inch cylinders exerting up to 81,000 pounds force, crushes and tightly compacts refuse with a *direct thrust at floor level.*

CYCLE COMPLETE
Packing panel completes
the body, then locks in po
is Cyclomatic Packing!
development, it provides
with the fastest loading
tion, of any refuse-collec

NEW GLIDE-AWAY HOPPER CLOSURE – To seal hopper, just touch a lever, and door glides quietly and quickly into place. Door can be locked in closed position for traveling to disposal point. Door glides easily to open position, where it is automatically locked. Complements the modern, functional styling of the all-new LOAD-PACKER 500. Here's a unit that will be a point of civic pride in your community for all the many years it serves you!



ADING IN 4 SECONDS –
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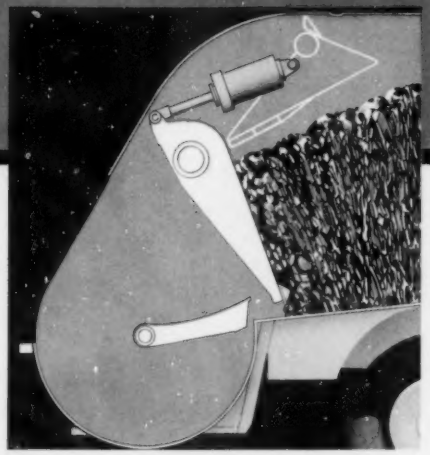


CYCLE COMPLETE IN 10 SECONDS – Packing panel completes its powerful stroke *inside* the body, then locks in position to retain load. This is Cyclomatic Packing! An exclusive Gar Wood development, it provides the LOAD-PACKER *500* with the fastest loading action, greatest compaction, of any refuse-collection unit ever built!

To order these helpful booklets check the reply card opposite page 78

To order these helpful booklets check the reply card opposite page 78.

WEED AND DUST CONTROL

Dust Control Made Easy

30. Details on an effective solution for your dust annoyance problems are presented in a colorful bulletin. "Gulf Sani-Soil-Set—the modern, proven agent for controlling dust." Get your copy to learn how this long-lasting, easily applied material can be of help. Write Gulf Oil Corp., 1822 Gulf Bldg., Pittsburgh 30, Pa. or check the reply card.

How to Prepare and Maintain Roadways With Calcium Chloride

65. "The Calcium Chloride Road," is the name of a new 24-page two-color catalog issued by the Columbia-Southern Chemical Corp., 632 Fort Duquesne Blvd., Pittsburgh 22, Pa. Included are sections on dust control, gradation, placing and mixing materials and shaping. General information on spring, summer and fall maintenance is also provided. Check the handy reply card.

Weed Killing Case Histories

205. Long term weed and grass control . . . costs less with Du Pont "Telvar" weed killers. Interesting folder published by Grasselli Chemicals Dept., E. I. Du Pont de Nemours & Co., Inc., Wilmington 98, Del. Full color photographs demonstrate effective action; text shows application methods for best results. Check the reply card for your copy.

How to Cut Weed Control Costs

308. Information on a weed killer that can save hundreds of man-hours of clearing and cutting is available from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio. Whether you want to control weeds or brush or both, without damage to crops or ornamentals, get this literature today by checking the reply card.

REFUSE COLLECTION AND DISPOSAL

Engineering Data on Incinerator Design

118. A comprehensive bulletin which provides full engineering data on municipal refuse incineration is offered by Pittsburgh-Des Moines Steel Co., 3422 Neville Island, Pittsburgh, Pa. This 20-page booklet shows basic requirements for satisfactory incineration, gives incinerator design details and describes modern mechanical stoking, construction features and modernization of existing plants. Get your copy by checking the reply card.

New M-B Packer Body Designed for Maximum Payload

309. The M-B Packer Body, designed to provide maximum payload on a minimum size, low-cost truck, features effective, simple compaction system; provides easy loading, positive discharge, all safety features. Available in 12-14-16, 20, 24 cu. yd. capacities. Get all the facts from M-B Corp., New Holstein, Wis.

Complete Package Dravo Incinerator Plant

584. The Dravo incinerator includes receiving pits, automatic refuse handling system, automatic combustion controls, traveling grate stoker and everything necessary for the efficient operation of the plant with minimum personnel. Write for full information to Dravo Corp., Dravo Building, Pittsburgh 22, Pa., or check the reply card.

Information on the Hydepak Refuse Packer

614. The Hydepak refuse packer is designed so that a lighter more economical truck body can be used and the packer is available in 13, 16, 20 and 24 yd. capacities. For complete specifications write Hyde Corp., P. O. Box 1265, Fort Worth, Tex., or check the reply card.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Check These Features On Refuse Collection Bodies

383. The Heil "Colectomatic" refuse collection unit incorporates the best features suggested by municipal operating crews, supervisors and private operators to provide easy loading, simple operating mechanism, bulldozer type packing, fast dumping and many other important advantages. Available in 16 and 20 cu. yd., capacities. Check them all by getting attractive Bulletin BH-54103 from The Heil Co., 3044 W. Montana St., Milwaukee 1, Wis. Your copy is ready—just check the reply card.

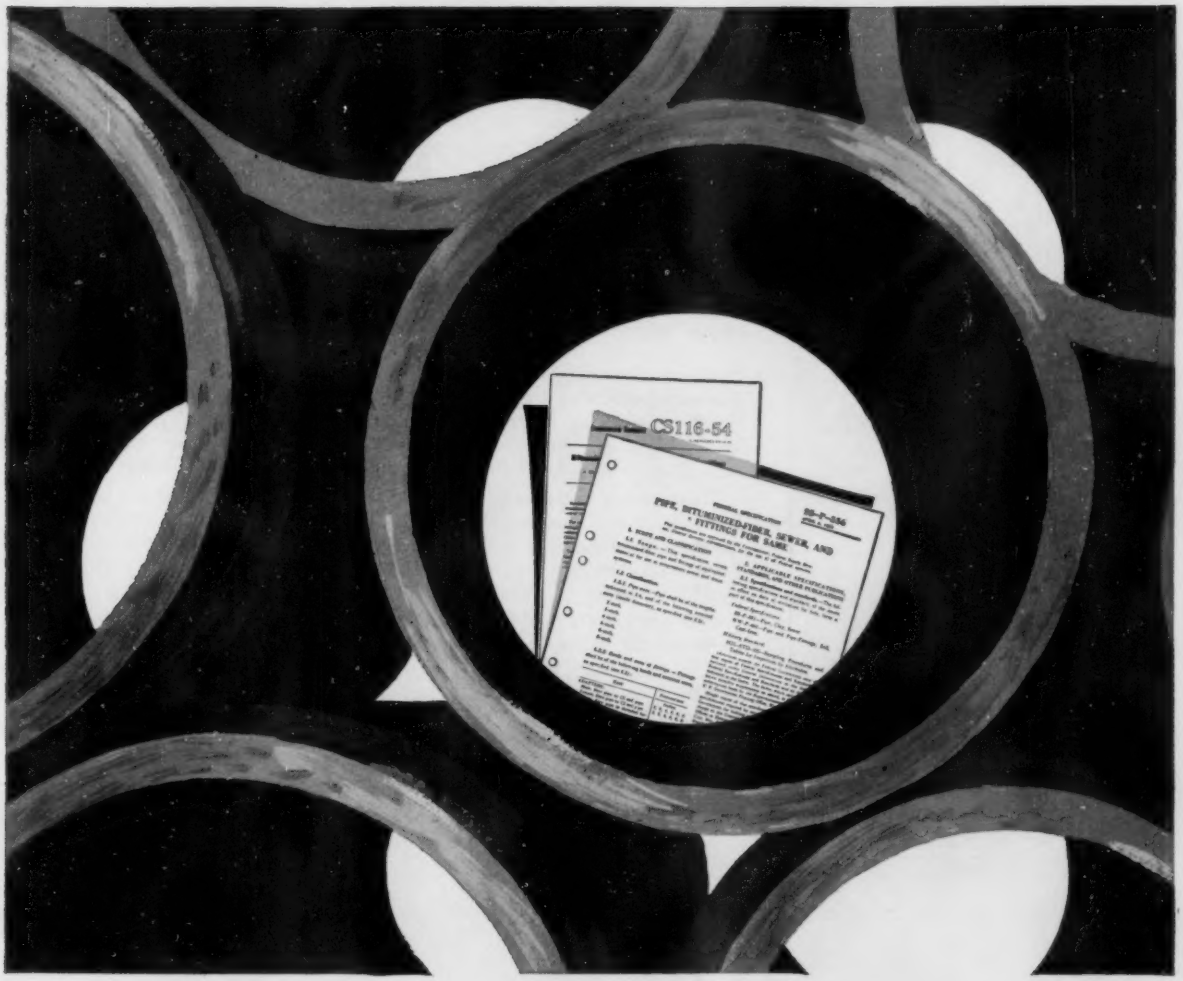
Data on Refuse Collection Bodies

615. The Hydro E-Z Pack compacting unit has only 2 working parts—a high volume roller bearing pump and a double-acting telescopic cylinder. A refuse-crushing compacting pressure of 82,500 lbs. is attained in the units. Write Hydro E-Z Pack Co., Galion, O., or check the reply card for complete specifications.

RECREATION

How to Equip Your Parks and Playgrounds

414. A handsome 60-page illustrated catalog showing a full line of extra heavy duty playground, pack-picnic and dressing room equipment, plus many related items, is now available from American Playground Device Co., Anderson, Ind. Complete specifications, construction features, prices and details of labor and materials needed for installation are included. Check the reply card.



BERMICO® Bituminized Fibre Pipe

Exceeds Federal Specifications SS-P-356

Code authorities throughout the country are including Bermico bituminized fibre pipe in their codes because it exceeds Federal Specifications SS-P-356 . . . and passes Commercial Standard CS116-54.

Why it belongs in your code: Bermico, the tough cellulose fibre pipe impregnated with coal tar pitch, resists acids and alkalies, stands up under soil settlement and temperature changes—even boiling water—and provides lasting protection for house-to-septic tank or sewer connections.

Exceeds Federal Government performance requirements for Water Absorption—Crushing Strength—Chemical and Kerosene Resistance—Hot Water Resistance—Heat Resistance—Resistance to Flattening—Beam Strength.

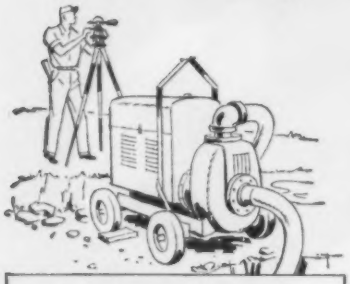
Convenient 8-foot lengths for fast, economical installation—in all diameters from 2" to 6". The only bituminized fibre pipe with a full line of fittings—Wyes, Tees, and Bends—of the same material.

Inquire about new full-color movie: "Modern Pipe For Modern Living." Write Dept. BE-6, Brown Company 150 Causeway Street, Boston 14, Mass. (Mills: Berlin, Gorham, North Stratford, N. H.; Corvallis, Ore.)

BERMICO®
for house to sewer or septic tank
BERMISEPTIC®
for septic tank disposal fields

Guarantee of Quality BPI BITUMINOUS PIPE INSTITUTE

New "pipeline to profits" on every construction job!



Big aid to contractors, this new "job-applied" Pump Selector. Helps you avert costly delays—improves job-to-job efficiency—by moving more water faster . . ."on schedule!"

Barnes Pumps Speed...

- General Construction
- Road Paving
- Gravel Pits
- Pipelines
- Concrete Mixing
- Mines
- Utilities

For most effective handling of liquids and semi-solids in excavations, mines, on highways and general construction projects, Barnes engineers developed a number of broad-purpose centrifugal pumps that meet practically all of your daily requirements.

Next step was to make it easy to pick just the right one for the job. Our new Construction Pump Selection Chart is the perfect answer. Operations you perform regularly . . . matched with the pumps that do the job best . . . are keyed to give you the right combination at a glance!

Ask your Barnes distributor for your free Construction Pump Selector. Or write to us for a copy right now, Dept. V-67

BARNES MANUFACTURING CO., Mansfield, Ohio

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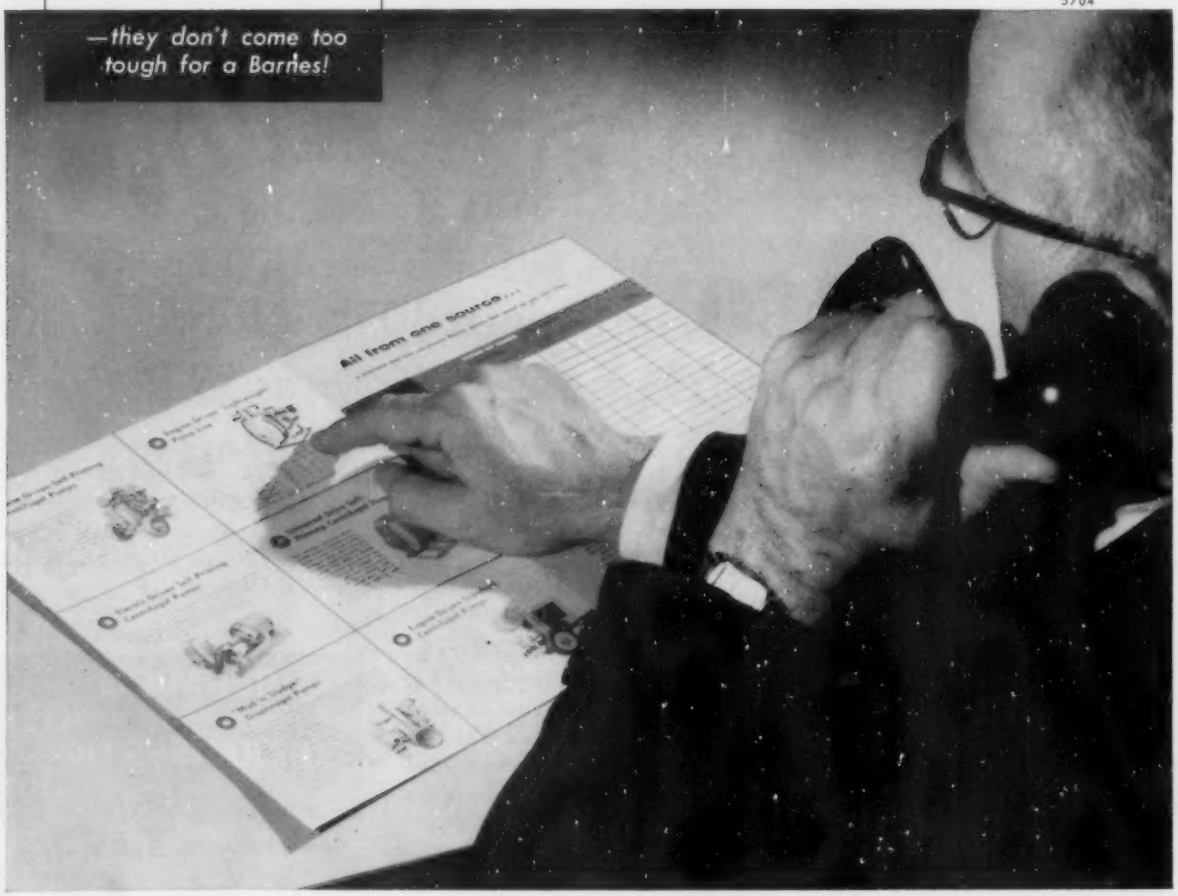

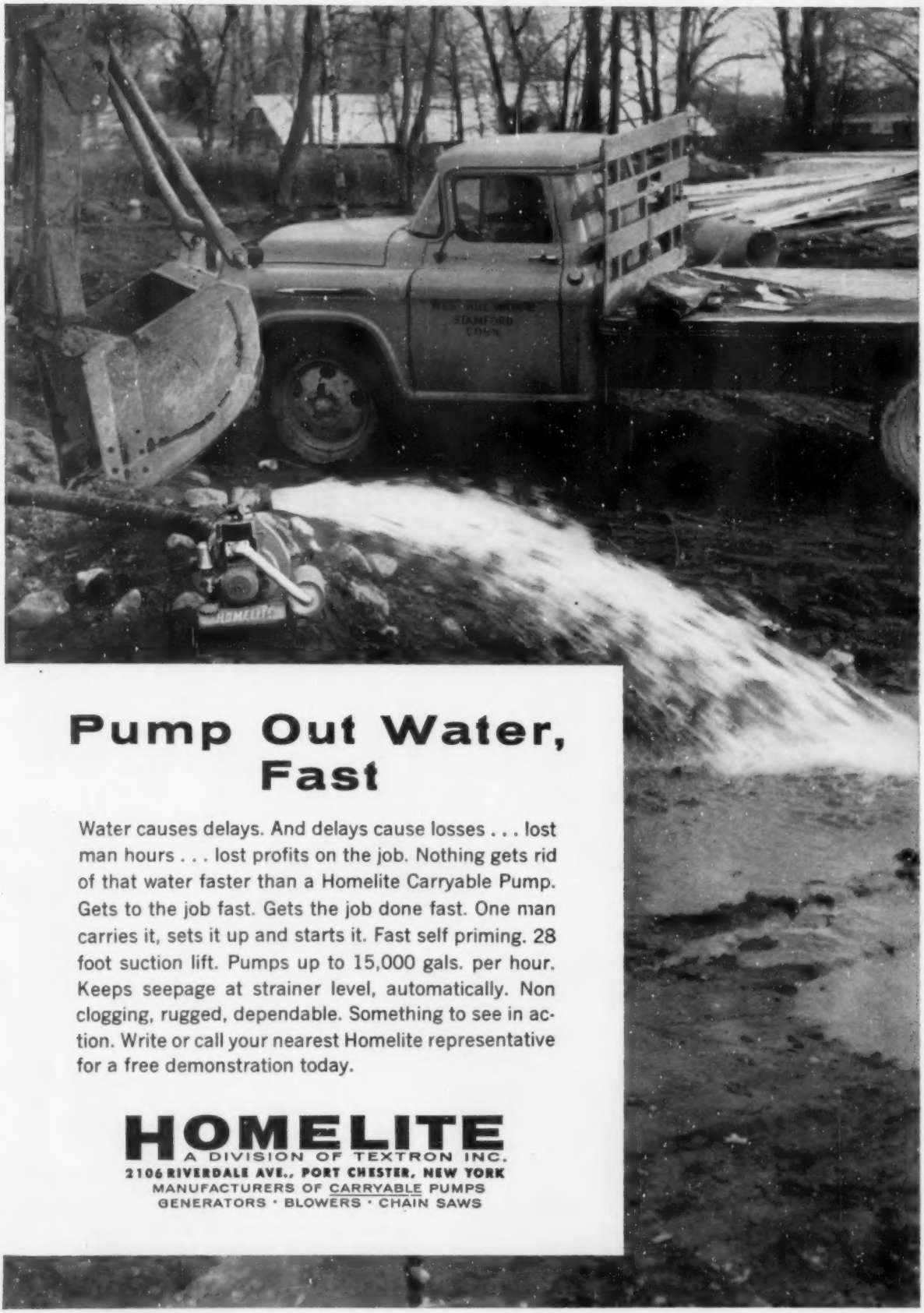

Pump Out Water, Fast

Water causes delays. And delays cause losses . . . lost man hours . . . lost profits on the job. Nothing gets rid of that water faster than a Homelite Carryable Pump. Gets to the job fast. Gets the job done fast. One man carries it, sets it up and starts it. Fast self priming. 28 foot suction lift. Pumps up to 15,000 gals. per hour. Keeps seepage at strainer level, automatically. Non clogging, rugged, dependable. Something to see in action. Write or call your nearest Homelite representative for a free demonstration today.

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A DIVISION OF TEXTRON INC.
2106 RIVERDALE AVE., PORT CHESTER, NEW YORK
MANUFACTURERS OF CARRYABLE PUMPS
GENERATORS · BLOWERS · CHAIN SAWS

LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Signs of our Times

Hall v. Town of Keota, 79 N.W. (2d) 784, an Iowa case decided Dec. 11, 1956, involved a suit by the father of a child who was killed when a heavy cast iron post, used by the Town of Keota to carry a "No U-Turn sign," fell on him. The pole was originally used as a light pole by the other defendant, Iowa Southern Utilities Co., but some time before the company had installed a new system and the town had used it thereafter as a traffic sign device.

It was alleged that the pole was not kept in good repair and safe condition; that it was not securely fastened to the sidewalk, but the bolts and nuts used to anchor it had become worn and rusted so that they were useless; and that the pole in such condition became a trap and an inherently dangerous instrumentality. It was alleged that this was actionable as negligence, and as a nuisance.

The Town of Keota demurred to the complaint, on the ground that in maintaining the pole it was acting in a governmental rather than a proprietary capacity, and was therefore as a matter of law immune from liability. The case against the Town of Keota was dismissed by the trial court on this ground.

The plaintiff then appealed to the Supreme Court of Iowa. The court held: (1) that the maintenance and repair of streets is a governmental function; (2) that a sidewalk is a part of the street; but (3) that by statute, municipal corporations are expressly given the duty to keep the streets "in repair and free from nuisances", and that this destroys the governmental immunity of the municipality and renders it liable in damages if a user is injured because of such failure and without fault on his part; (4) in contrast with this rule, however, the statute holds municipalities liable only for the ultimate results—injuries from defects in the streets which it has not used due care in preventing, and not for negligence in the manner of carrying out repairs or construction work.

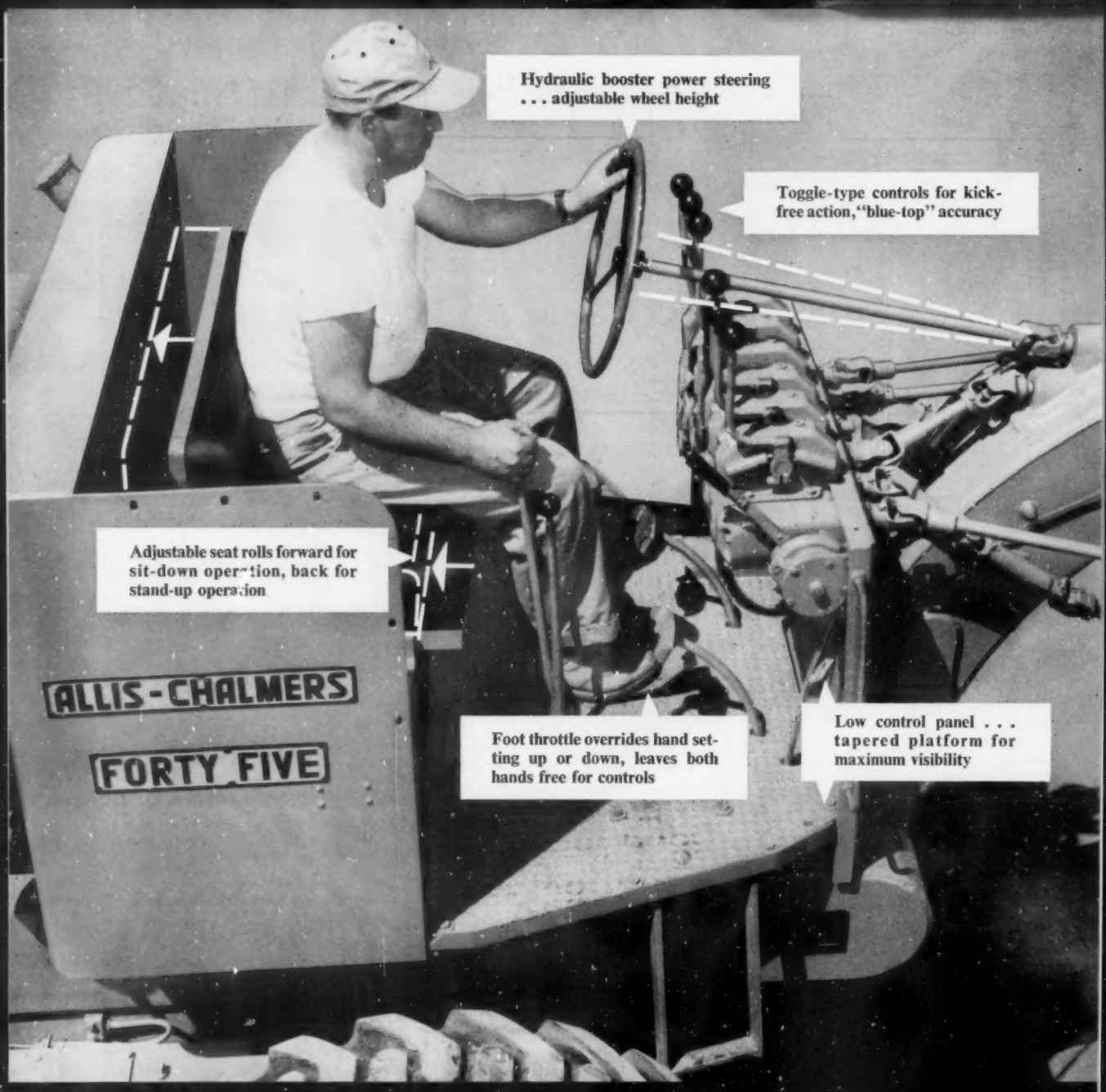
In the present case, the court held, the traffic sign was directly connected with the intended use of the street. It was a means of regulating travel on it. The town owed a duty to keep it in repair. While the town's failure to do so may not have amounted to a nuisance, it did amount to negligence if the facts were as alleged by the plaintiff. Therefore, the trial court's dismissal was reversed, and the case was sent back for trial to determine whether the facts were actually as alleged by plaintiff. If found to be so, the town was to be held liable for the boy's death.

This distinction between *liability for direct injuries* caused by failure to keep traffic signs or lights in repair, and *immunity from liability* for improper methods of maintaining them, is also pointed out by McQuillan, in "Municipal Corporations", 3d Ed., Sec. 53.42; and seems to be reasonably well established.

Taking the Gas Pipe

Gallipo v. City of Long Beach, 304 Pac. (2d) 106, a California case decided Dec. 3, 1956, was an action by the father of an eight year old boy against the City of Long Beach for injuries sustained when the boy fell while endeavoring to disentangle himself from a barbed wire barricade in the center of a gas pipe line on which he was attempting to cross a gap spanned by the pipe line and an attached bridge having no pedestrian walkway.

The bridge had originally been constructed before 1913 by the Pacific Electric Railway over the tracks of its right of way. Outside the railing of the bridge is a gas



FIVE WAYS YOU CAN BOOST GRADER PRODUCTION

. . . through operator comfort and control!

Features like these make satisfied operators . . . mean more production for you. They're yours in an Allis-Chalmers FORTY FIVE—120 brake hp, 23,800 lb. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*

pipe and supporting structural members. The City of Long Beach has operated and maintained the bridge and its appurtenances since 1924. The roadway portion of the bridge constitutes a two-lane arterial street used by vehicular traffic. This is the only bridge in Long Beach on which there is no provision for a pedestrian walkway.

The pipeline is about one foot in diameter and is substantially level with the roadway. The pipeline is attached to the bridge by a supporting structure, part of which consists of two horizontal planks one on each side of the pipe, one of these planks running the full length of the bridge and the other about three-quarters of the way. There is no barrier at either end of the approaches to the bridge or pipeline to prevent pedestrians from walking on the pipeline or on the planks. The grass alongside the bridge has been flattened and beaten into what appears to be a defined path leading to the pipeline structure. However, near the center of the bridge and outside the railing there are two 2″x4″ beams. Several strands of barbed wire were loosely strung between the two boards and dangled over the edges.

The boy had frequently crossed the bridge via the pipeline, though warned by his parents not to do so. On this particular occasion, he and three other boys were playing together and started to cross the bridge on the pipeline, to get to a "favorite spot" on the other side of the bridge. Danny made his way with one leg on each side of the pipe "kind of scooting" along. Bobby, who had just stepped on the pipeline, noticed that as Danny tried to go under the barbed wire, his pants were caught by the wire, and as he bent over to extricate himself, he fell 25 feet to the ground below.

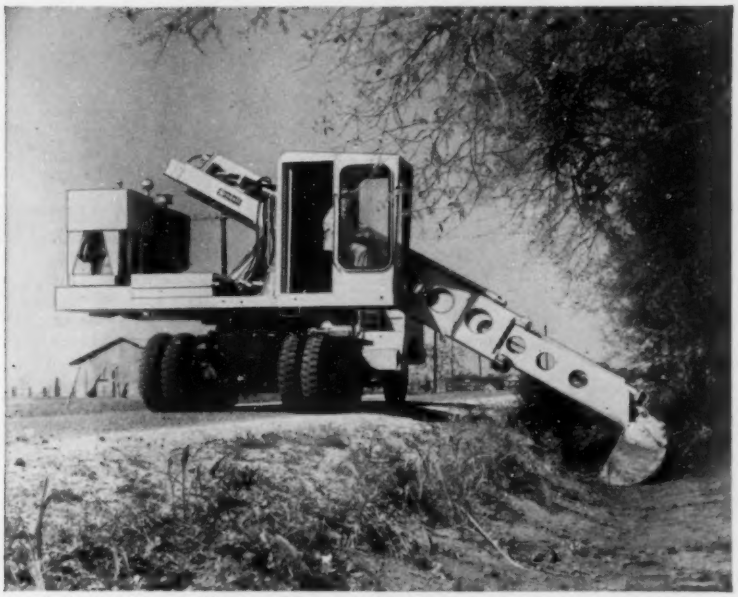
There was also evidence that the City knew that children regularly crossed the bridge to reach two grammar schools in the vicinity.

The trial court dismissed the case. On appeal, the court held that it could not be said whether or not the City had taken reasonable action to protect the public from the foreseeable risks of injury. It was a question of fact which should have gone to the jury. The case was therefore sent back for trial.

As a result, we don't yet know whether or not the City will ultimately be held liable, and we won't know until we get the jury's verdict. In the meantime, ... *you be the jury.*

TWO GRADALLS SAVE $147,763 ANNUALLY FOR CITY OF PORT ARTHUR, TEXAS

Handle complete surface drainage maintenance



Gradalls handle complete maintenance of surface drainage systems for City of Port Arthur—saving 76,960 man hours a year.

Port Arthur also uses its Gradalls on water and sewer department improvement projects.

HOW MUCH does labor cost? An analysis of your own cost records may be quite revealing—as the City of Port Arthur, Texas, found out recently. After a thorough cost analysis on the maintenance of their surface drainage systems, they discovered the use of their two Gradalls versus hand labor resulted in an annual savings of $147,763!

M. C. Creswell, Port Arthur's Supt. of Public Works, stated, "Prior to the purchase of our two Gradalls, we used 55 men and 8 trucks in an unsuccessful attempt to maintain our surface drainage. Now, with the Gradalls, 18 men and 6 trucks, we do more work and *do it better.* This reduction in manpower —76,960 man hours a year—means a cost savings to us of $147,763 annually. So, it didn't take long for the Gradalls to pay off their cost. It also enabled us to transfer 37 men into undermanned departments."

Recently, Port Arthur put one of their Gradalls full time on a sizable program of improvement projects. As work progressed, it often became necessary to use the second Gradall to keep operations running efficiently and maintain work schedules. So to keep all programs up to date, the City of Port Arthur has just purchased their *third* Gradall.

Why not arrange for a field demonstration with your nearest Gradall Distributor? Let him show how this multi-purpose machine can cut your costs, eliminate costly, time-consuming hand labor and speed job completion.

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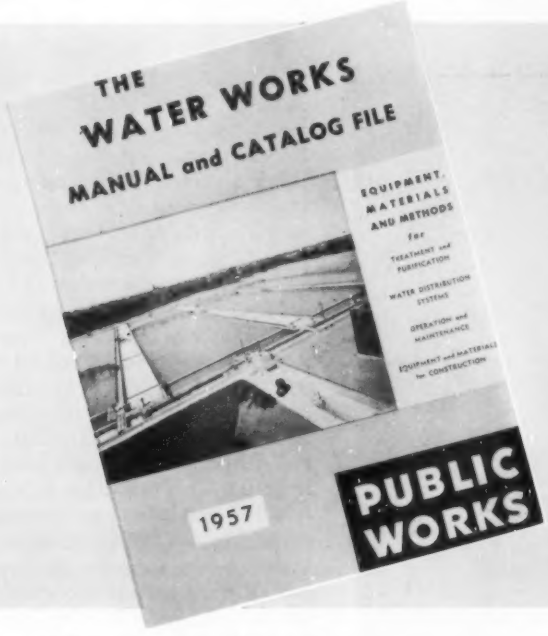

"The most valuable book that comes into this office," **said the Superintendent of one of the country's largest water departments recently. (Name on request)**

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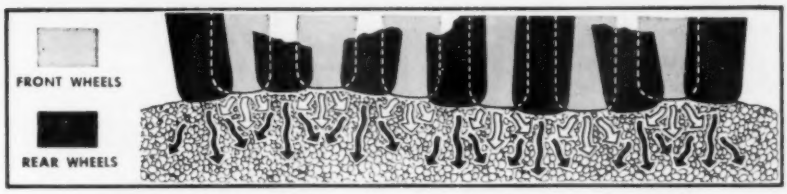
ROAD ROUGHNESS AND SLIPPERINESS

This Bulletin contains five papers presented at the 35th Annual Meeting of the Highway Research Board. The first paper, by Gale Ahlborn and Ralph A. Moyer, deals with modifications to the BPR roughness indicator as developed in California, together with some test results using the equipment on actual pavements. In the second paper, B. R. Petrok and K. L. Johnson described modifications developed in Minnesota for the same instrument. Virginia experience with skid resistant pavements is described by F. P. Nichols, J. H. Dillard and R. L. Alwood in a paper giving several different methods of test, and the results of stopping distance tests made at several hundred locations in that state. In a paper describing similar work, H. L. Michael and D. L. Grunan discuss the program of developing skid testing in Indiana and the results of tests in that state. How passenger car speeds are affected by driver reaction to wet and dry pavement conditions was the object of a New York State study reported by Walter Stohner in the fifth paper. Copies are available from the Highway Research Board, 2101 Constitution, Washington, D. C. at $1.60 per copy.

SUMMARY OF RESEARCH PROJECTS PRESENTED BY HRB

This review is designed to provide a listing, classified by subject, of highway research projects in progress or reported by state highway departments, federal bureaus, colleges and universities and other agencies. The primary purposes of this compilation are to acquaint the active research worker with the parallel activities of other agencies, thus forestalling duplication of efforts, and to give the general technical personnel a preview of future highways, which will be assuredly better as these research findings are absorbed in the bloodstream of regular routine highway operations. Copies are $1.60 each and are available from Highway Research Board, 2101 Constitution Ave., Washington 25, D. C.

Exclusive Wobble-Wheel principle is illustrated at right. Note how each tire applies weaving pressure, kneading the material. Note also how front and rear tire paths overlap to provide 100% coverage in one pass. Axles also move vertically allowing tires to hug rough surface.



BROS Wobble-Wheel rollers have the proved advantages of rubber-tire compaction *plus* the fast, thorough penetrating action of the exclusive BROS Wobble-Wheel principle. Performance is unmatched for earth fills, crushed rock bases, stabilized roads and runways. Also, faster, more thorough coverage is obtained on rough compaction jobs.

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Vital "kneading" action of the rubber tires is multiplied by a lateral rocking motion in each wheel; this penetrating, earth-settling force quickly eliminates voids, interstices and subsurface "bridging".

Oscillating axles on each wheel pair give tires contour-clinging, vertical action . . . assure constantly uniform weight distribution and equal compaction pressure at all times; prevent blowouts by permitting tire pairs to go up and over uneven surfaces. Also, axles guarantee full coverage of all low spots.

Crushed rock bases are "locked" into position tighter and more effectively.

Flexibility of specially designed, smooth tread tires prevents deterioration of chips.

Each wheel is individually mounted on heavy duty, Timken tapered roller bearings; this feature adds to rugged dependability and minimizes upkeep.

You're bound to turn out superior compaction in fewer passes with a BROS rubber-tired Wobble-Wheel roller. See us now for complete details and a convincing demonstration.

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WATER QUALITY AND FLOW VARIATIONS

This is a compilation of basic data that includes a four-year continuous and systematic record of analyses at eleven points throughout a 600-miles stretch of the Ohio River. Federal, state and municipal agencies, as well as industries and consulting engineers, will find this basic data useful in many phases of water-resources planning. The book is published by Ohio River Valley Water Sanitation Commission, 414 Walnut St., Cincinnati 2, Ohio.

STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES

The Bureau of Public Roads has available a 363-page book entitled "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects." The book contains up-to-date specifications for those items of work and materials and construction methods that are generally applicable to direct Federal Highway contracts. These specs will undoubtedly be of interest to specifications writers in particular and to most engineers in highway design and construction, as well as to engineering students. The book is available from the Supt. of Documents, U. S. Government Printing Office, Washington 25, D. C., at $2 a copy.

PRACTICAL APPLICATIONS OF ENGINEERING SOIL MAPS

The College of Engineering of Rutgers University, has released Report No. 22 in the series of Engineering Soil Surveys of New Jersey, which embraces specific reports and engineering soil maps covering the soil conditions to be found in each county of New Jersey. This project, sponsored jointly by Rutgers and the New Jersey State Highway Dept., has already proved its value in reducing highway costs by permitting more accurate design and lessened maintenance, while its usefulness for local planning purposes is widely acknowledged. This report explains the soil-mapping technique and notation, indicates the location of natural materials in New Jersey, and discusses the many practical uses to which the engineering soil maps may be put by engineers in designing roads, foundations and airports and by planning agencies. It is priced at $3 a copy and contains 114 pages, 14 four-color photographs, 31 figures and 8 tables, and is published by the Rutgers University Press, New Brunswick, N. J.

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New England Sewage & Industrial Wastes Ass'n
Newport, R. I., June 6

New Jersey Section, AWWA
Summit, New Jersey, June 6

N. I. A. A. Conference
Waldorf-Ast, New York, June 9-12

Pennsylvania Section, AWWA
Bedford Springs, Pa., June 12-14

New England Water Works Ass'n
York, Maine, June 13

International Municipal Signal Ass'n, Southwest Section
Amarillo, Texas, June 13-15

New York Sewage and Industrial Wastes Ass'n
Lake Placid, N. Y., June 17-18

Ohio Sewage and Industrial Wastes Ass'n
Dayton, Ohio, June 19-21

Iowa Sewage and Industrial Wastes Ass'n
Des Moines, Iowa, June 19-21

Central States Sewage and Industrial Wastes Ass'n
Chicago, Ill., June 26-28

Pennsylvania Sewage and Industrial Wastes Ass'n
University Park, Pa., Aug. 28-30

Wisconsin Section, AWWA
Milwaukee, Wisconsin, Sept. 4-6

New York Section, AWWA
Lake Placid, N. Y., Sept. 11-13

South Dakota Sewage and Industrial Wastes Ass'n
Sioux Falls, S. D., Sept. 11-13

New England Water Works Ass'n
Boston, Mass., Sept. 15-18

International Municipal Signal Ass'n
Miami Beach, Fla., Sept. 16-19

Ohio Section, AWWA
Cincinnati, Ohio, Sept. 18-20

Public Works Congress and Equipment Show
Philadelphia, Pa., Sept. 22-25

Kentucky-Tennessee Sewage and Industrial Wastes Ass'n
Louisville, Ky., Sept. 23-25

Michigan Section, AWWA
Detroit, Michigan, Sept. 25-27

Okla. Sewage and Industrial Wastes Ass'n
Stillwater, Okla., Sept. 25-26

North Central Section, AWWA
Fargo, N. D., Sept. 25-27

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Boston, Mass., Oct. 7-10

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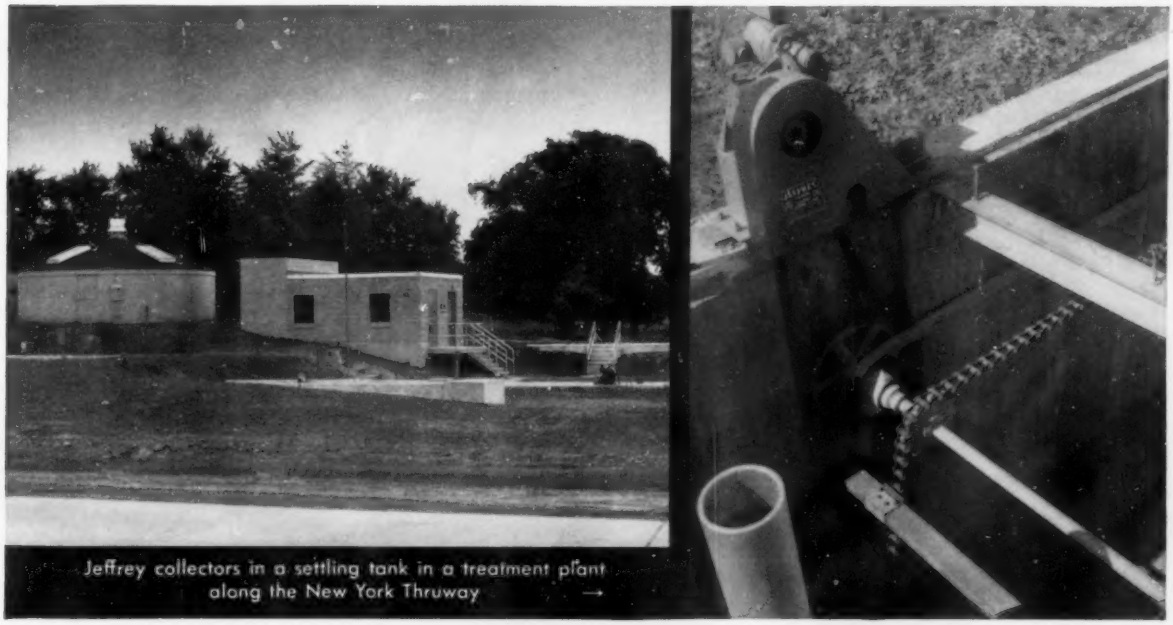
introduce problems of sanitation...



Jeffrey collectors in a settling tank in a treatment plant along the New York Thruway →

Jeffrey equipment is helping solve them

IT'S SMALLER in size, of course, to meet the demands of these thruway service areas. But the Jeffrey Sanitation Equipment employed has the same high degree of dependability as that used in hundreds of sewage, water and industrial waste treatment plants all over the world.

Jeffrey engineers' broad experience in the design and construction of sanitation systems covers all kinds of treatment needs. You can turn your treatment problems over to them with complete confidence. Jeffrey equipment can be depended upon to perform well and faithfully.

Catalog 905 describes Jeffrey Sanitation Equipment. For a copy, write The Jeffrey Manufacturing Company, 947 North Fourth Street, Columbus 16, Ohio.

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But once *in*, our revolutionary new "Tyton Joint" pipe seals bottle-tight. Hydrostatic tests on restrained "Tyton Joints" show that they will withstand pressures well in excess of hydrostatic test pressures required by the pipe specifications.

And only *one* accessory needed...a simple rubber gasket. This gasket fits into the bell end, and the connecting pipe compresses the gasket and seals the joint permanently. No bell holes. No delays. "Tyton Joint" pipe can be laid in rain or a wet trench. And even the newest crew can handle it.

Like full information on "Tyton Joint" pipe whose installation is simple, speedy and sure? Call or write us today and get the facts that will save you time, trouble, money in the trench.

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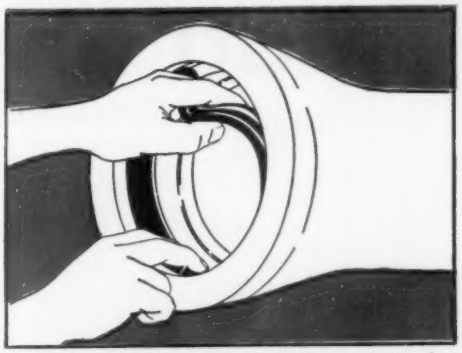
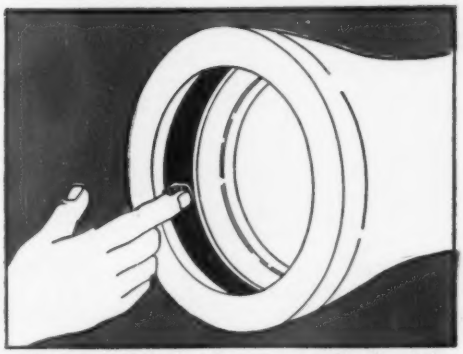
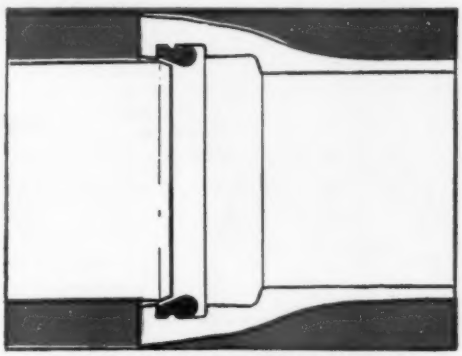


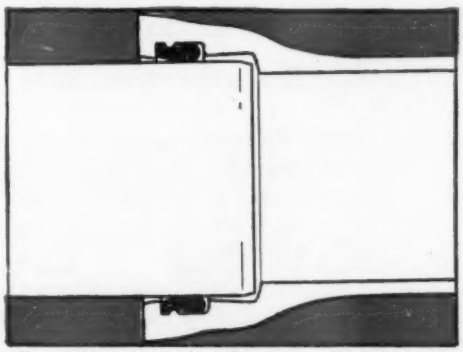
Insert gasket with groove over bead in gasket seat



Wipe a film of special lubricant over inside of gasket



Insert plain end of pipe until it contacts gasket



Force plain end to bottom of socket . . . the job's done!

The Big Fleets buy more than any other make!

NEW F-100 pickup with Styleside body standard at no extra cost. Up to 41% more loadspace than other half-tonners.

New Tilt Cab line offers six series from 18,000-lb. GVW to 60,000-lb. GCW. All the advantages of "cab forward" compactness, plus better engine accessibility.

Why? . . . because on-the-job performance and low operating costs prove FORD trucks cost less!

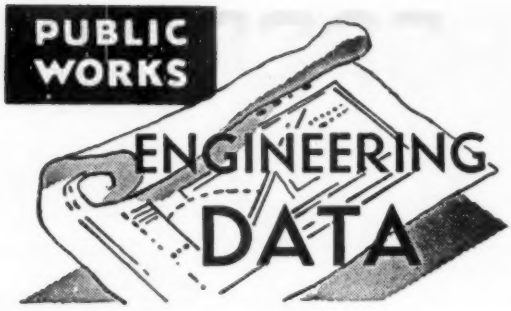
Take a tip from the men who buy trucks every year. Official truck registration data shows that owners of America's biggest commercial truck fleets are buying more Ford trucks than any other make!

Municipalities, large and small, have found Ford trucks are best for their fleets. To begin with, Ford's initial costs are low. Many models are priced below all competitive makes. For example, the new Ford Tilt Cab models are America's lowest-priced!*

And it costs less to run a Ford truck! Thanks to modern Short Stroke power and sturdy chassis construction, operating costs and "shop time" are reduced. Another important Ford plus is longer truck life—a fact certified by independent insurance experts.

Add it all up—you'll find Ford trucks do cost less! Contact your Ford Dealer . . . let him show you why the big fleets are buying more Ford trucks than any other make.

**Based on comparison of manufacturers' suggested retail prices*



Bid Prices on the Salem, Oregon, Pipe Line

Salem, Ore., is beginning the construction of a pipe line some 20 miles in length from an inlet on the North Santiam River to the City. This line, which will reinforce an existing 36-in. pipe, will be 54-inch from the headworks to the Turner Reservoir and 48-in. from there to Salem. Clark & Groff of Salem are the consulting engineers and John L. Geren is Manager of the Water Department.

Bids were opened on Feb. 21 and the contract was awarded to Lord Bros. of Portland at $3,036,000, exclusive of a section of 42-in. pipe at the city end of the line. Alternate bids were taken on steel and on modified prestressed concrete cylinder pipe. The contract was awarded on the concrete pipe.

For trench excavation, preparation and backfill on 35,620 ft. of 48-inch pipe, the price bid by Lord Bros. was $4.00 per ft.; and on furnishing and laying the pipe $26.00 per ft. Next lowest bid on furnishing and laying pipe was $27.00; but on trenching, preparation and backfill, bids ranged from $3.20 to $14.00 per ft.

On the next section, 2,817 ft. long, the trenching preparation and backfill bid by Lord Bros. was $5.00 per ft., with furnishing and laying 48-inch pipe at $27.90. For the 49,716 ft. of 54-in. pipe, prices were $5.00 and $29.75 respectively.

On the 48-in. section, one crossing under a railroad and one under a highway were required. The bid by Lord on these were $13,700 and $5,000. Other bids ranged from $10,000 to $13,227 on the railroad crossing and from $4,490 to $10,000 on the highway crossing which will be a rather difficult problem. There were also a number of creek and irrigation ditch crossings, some difficult. There was also a railroad crossing on the 54-in. line on which the successful bidder's price was $11,075. A crossing of one branch of the North Santiam River, from Station 974 + 43 to 976 + 86, was bid at $11,075. The upper end of the 54-inch line presents some difficult problems through swamp and brush areas.

Snow and Ice Control in Wayne Co., Mich.

The snowfall for the winter of 1955-56 in Wayne Co., Mich., was 45.2 in. compared to the average of 39.4 inches for this area; consequently, the snow-removal problem was as anticipated. The Highway Maintenance Division operated 110 trucks equipped with mechanical spreaders and snow plows, and 14 motor patrols from its various maintenance yards throughout Wayne County. Predetermined routes were followed by drivers so that state trunklines and county primary roads received attention first, local roads next, and residential streets last. Frequent snowfall packed by heavy traffic on the

THIS OPEN DOOR GUARDS YOUR MOST VITAL SERVICE

Water is your community's life blood. Water meters are universally accepted as the fairest way to charge for water . . . and the only way to keep people from wasting water.

But water meters, being fine instruments, naturally lose accuracy after years of wear. They start to give away revenue. They permit leaks and carelessness to creep back, and pumping costs go up. Eventually the water system cannot cope with the growing demand.

Worse yet, lack of proper income makes people hesitant to act, and water shortages may soon become critical.

How guard against this? Pick meters that stay accurate longer. Set up a good testing and repair program.

Walk into your meter repair shop. Talk to the men whose efforts guard your water supply. Ask them which meter gives highest sustained revenue . . . with lowest repair and depreciation costs. We sincerely believe the answer will be "Trident."

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roads creates an icy condition; therefore, salt is applied promptly over the surface of the highway by trucks equipped with mechanical spreaders. These spreaders are powered off the real wheel of the truck so that the amount of salt deposited on the road is a function of the opening between the ribbed roller and the spreader box and is independent of the actual speed of the truck. Approximately 61,000 tons of salt were used during the winter. It was stock-piled in 15 strategic locations throughout Wayne County to lessen the distance to critical areas.

Snow fence was used on county roads where necessary. It was erected in November before the first snowfall and removed in the spring. Snow fence prevents roads from filling with snow where the contour of the road is low.

Graduate Program in Sanitary Engineering

A new graduate program in sanitary engineering will be offered starting in June and September 1957 by the department of civil engineering of the University of Cincinnati Graduate School of Arts and Sciences.

Joining with the civil engineering department, Institute of Industrial Health, and Kettering Laboratory, all of the university, are the local Robert A. Taft Sanitary Engineering Center (national research laboratory of the United States Public Health Service), and the local Ohio River Valley Water Sanitation Commission. Graduate students in the course will have the opportunity of working with these and other co-operating agencies.

Open to full-time or part-time students in both the day and evening units of the university, the program leads to a master of science degree in sanitary engineering. A bachelor's degree in engineering or science is a prerequisite. In general, full-time students will be able to complete the requirements for a master's degree in a 12-month period. Further information can be obtained from the Department of Civil Engineering, University of Cincinnati, Cincinnati 21, Ohio.

Average New Water Service Cost and Charge

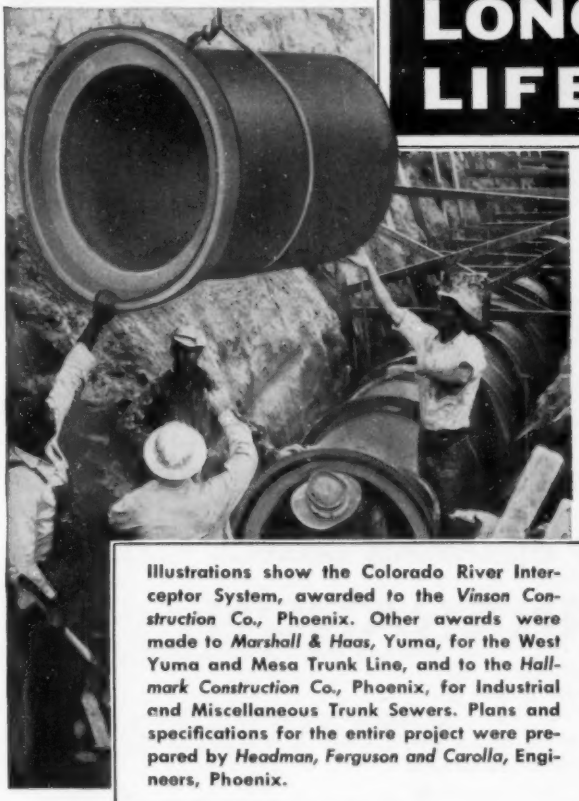
The Division of Water of Toledo, Ohio, reports on the average cost of making water taps and the sale price per tap. In 1956, only two 3/4-in. taps were made and the average cost was $114.16, compared to $75.08 in 1955 and $71.38 in 1954. Cost of making 1-in. taps averaged $97.78 each, compared to $79.38 in 1955 and $86.70 in 1954. For 1½-in. taps, the cost was $173.89; and for 2-in. taps $280.69. Average charge or sale price per tap was $91.32 for 1-in.; $182.67 for 1½-in.; and $261.02 for 2-in. Tap sales in 1956 amounted to $294,899, but tap costs were $314,624.

Two Cities Measure Cost of Local Services

A cost analysis made by Denver, Colo., showed that the capital cost to the city for a typical annexed area is $2,070 per dwelling or about $8,640 per acre. This is the amount necessary to provide schools, fire and police protection, sewers, streets and other facilities. As a result, an annexation fee of $2,000 per acre is charged and, in addition, a public site donation of 8 percent of the land area or a cash equivalent is required.

In the metropolitan area surrounding Sacramento, Calif., the cost of local government services runs about $400 per year per single family dwelling with a market value in the neighborhood of $12,000.

LONG TERM BOND FINANCING calls for LONG LIFE CLAY PIPE



Illustrations show the Colorado River Interceptor System, awarded to the *Vinson Construction Co.*, Phoenix. Other awards were made to *Marshall & Haas*, Yuma, for the West Yuma and Mesa Trunk Line, and to the *Hallmark Construction Co.*, Phoenix, for Industrial and Miscellaneous Trunk Sewers. Plans and specifications for the entire project were prepared by *Headman, Ferguson and Carolla*, Engineers, Phoenix.

YUMA, ARIZONA, is installing a new $1,600,000 sewer system and pumping plant, designed to meet the demands of its rapidly growing populace. Financed by a bond issue, the project calls for 14 miles of Vitrified Clay Pipe, in diameters up to 36 inches, serving both industrial and residential areas.

When dealing with bond-financed improvements, consulting engineers and civic planners can't afford to take chances. They have to choose materials they know will last. That's why the choice everywhere is Vitrified Clay Pipe. It's the one pipe you can be sure will still be in service long after the bonds have been retired. It's the one pipe that can stand up under the corrosive action of sewer acids and gases . . . can't corrode or disintegrate . . . can't wear out. Its long-term guarantee—*exclusive* with Vitrified Clay Pipe—is striking proof of its superiority.

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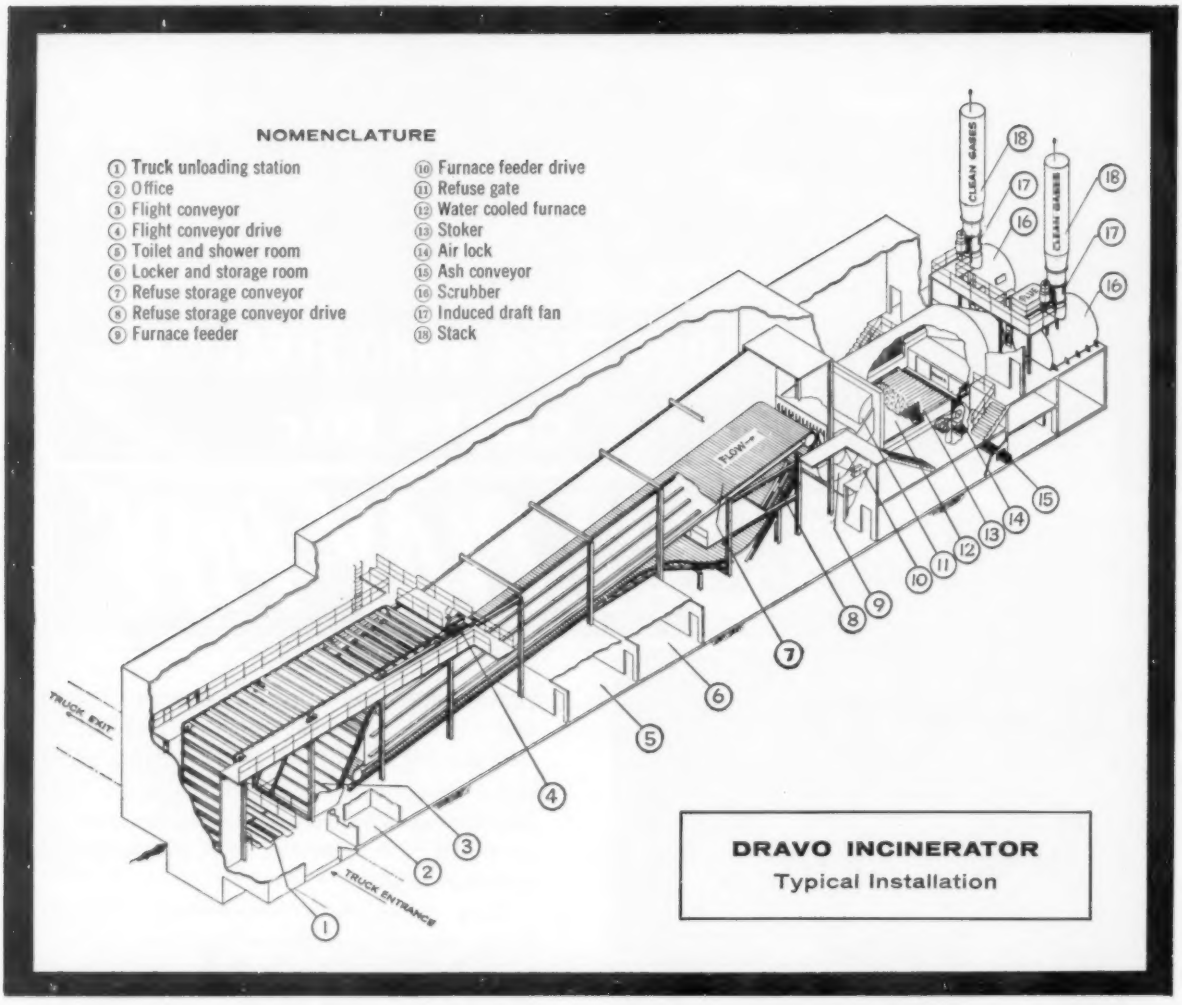

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Dravo Incinerator plants are designed for economical construction and are available in unit sizes from 3 to 40 tons per hour. If yours is among the many communities that are turning to incineration for efficient refuse disposal, it will pay you to learn how Dravo Incineration can save you money in both first cost and operating cost. For complete information, write to DRAVO CORPORATION, DRAVO BUILDING, PITTSBURGH 22, PA.

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Choking, blinding dust like this causes local resentment as well as presenting traffic hazards

Keep dust and danger down with low-cost COLUMBIA CALCIUM CHLORIDE road treatment

Don't let the roads you're responsible for fall into the too common condition shown above. The heavy dust thrown up from this surface is a major irritation to drivers and to residents. It's a real danger to life and limb. And dust like this means more money spent for materials and maintenance, just to restore the road that's blowing away.

Road treatment with Columbia Calcium Chloride is a surprisingly inexpensive way to eliminate dust formation during the hot, dry summer months ahead. One full application late this spring after shaping and crowning are completed, one or two "sweetening" shots during the summer . . . and you're assured of smooth, compact, dust-free surfaces that cut maintenance costs all year 'round.

If you haven't already, plan now to get Columbia Calcium Chloride on roads soon. It's also a great help in stabilizing shoulders and improving detours. Wherever you're located, Columbia Calcium Chloride makes both your roads and your budget look better and last longer.

Order ample stocks of Columbia Calcium Chloride today. For any added information, contact the Calcium Chloride Department at our Pittsburgh address or at any of our convenient district offices.

Consolidated shoulders should also be stabilized with Columbia Calcium Chloride to provide smooth, safe emergency surfaces

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SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
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NEW Holan derrick "stretches" to handle long poles

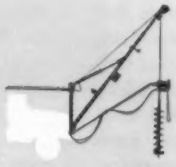
All Holan bodies are made of hi-tensile, rust-resistant steel 20 to 25% lighter than ordinary steels.

Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Service bodies for chassis up to 1½ ton. Lengths, 72", 84" and 102".

Aerial arm for spotting workmen 37 feet above ground, 9 feet below ground level. Double-basket unit extends 45 feet. Rotates 360°.

Ladders to 40' with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter.



Portable hydraulic and mechanical earth borers. Augers for 8" to 20" diameters, depth to 8'.

Hydraulic towers with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

Lifts heavy loads in low ranges, body-loads 4,000 pounds, comes low enough to power-feed diggers

No conventional derrick, this one. It has an extendible boom head that "stretches" the derrick an extra five feet (to 28 feet high) for handling poles up to 75 feet long. Yet, with boom head extended, little lifting capacity is lost. In a position about 10 degrees off vertical, it lifts 8,000 pounds; with boom head extended, it still lifts 6,000 pounds.

Two sets of cylinders provide greater lifting capacity in low ranges. Auxiliary lift cylinders raise the derrick almost to vertical, then the main lift cylinders take over.

Three other important features: (1) You can body-load 4,000 pounds (2) You can bring the derrick low enough to use digger power feed attachments (3) You can operate more safely by checking the new easy-to-read load indicator which gives capacities at all derrick positions.

Like other Holan derricks, this one is made of high-tensile steel and fits any body on its own supports. It also has Holan's lighter-but-stronger fabricated side legs. We'd like to tell you more. Write and ask about the Holan Series 6800 Power Derrick with or without Extendible Boom Head.

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THREE TYPICAL WORK BULL PACKAGES — (left foreground) Biggest and most powerful Work Bull, 52-hp Model 404 is equipped with hydraulically controlled backhoe (handles 12 to 36 in. buckets) which digs to a depth of 12½ ft. (background) 34-hp Work Bull Model 202 with side mounted mower. (right) Low-cost, 42-hp Davis Pit Bull features torque converter and foot-feed reversing clutches as standard equipment. Low-thrust principle of hydraulic grader-blade shown assures solid "bite" in roughest terrain.

Work Bulls pay off

in town, city, county, state, federal service

. . . as primary equipment

Work Bulls put former hand work on a paying power basis . . . provide far more versatility than other wheeled tractors in their work range. Work Bulls dig, doze, load, lift, grade . . . mow grass, plow snow, sweep roadways. Work Bulls more than earn their keep year round.

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With Work Bulls you get the exact power/equipment cost ratio the job demands . . . increase efficiency of equipment scheduling . . . cut down overhead. Work Bulls move from site to site through city traffic or cross-country—without permit troubles, without flatbed and other costs.

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M·H·F WORK BULLS

Division of Massey-Harris-Ferguson, Inc.

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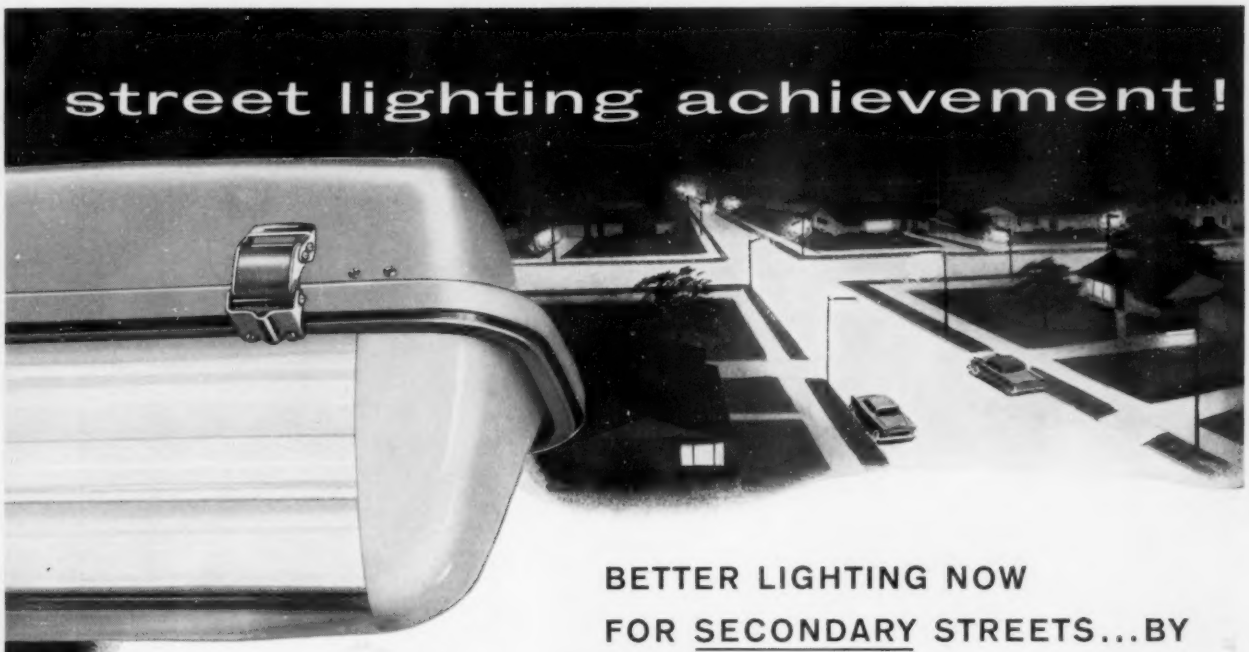

BETTER LIGHTING NOW
FOR SECONDARY STREETS...BY

5 MAJOR IMPROVEMENTS IN NEW 2-FSL FLUORESCENT LUMINAIRE!

Broader areas are bathed in natural, low-glare "high-visibility" light! All five specific refinements acclaimed by recognized Lighting Engineers!

All the outstanding success of today's modern lighting of primary streets—produced by the famous Westinghouse 4FSL (4-lamp) fluorescent luminaire—is now available for secondary business streets and important suburban thorofares!

Westinghouse has created a new, 2-lamp luminaire—the 2FSL—that capitalizes more completely than ever before on the use of tubular fluorescent light-source for street illumination.

This engineering of the 2FSL encompasses 5 distinct improvements. They are advancements providing unprecedented lighting efficiency, remarkably long service life, and speed and ease of application, installation and maintenance unparalleled in the past!

1. **Housing of Doubly Reinforced Fiber-Glass** is corrosion-free!—impervious to impact! *Cannot* dent! Permanent color is molded through. *No painting* is *ever* necessary! Wide flange creates ideal gasket seat and water shed!
2. **Globe of Acrylic Plastic** is light in weight but *extra* durable. Will not discolor, warp or crack. Is unaffected by weather, temperature or ultra-violet rays. Flanged edge "mates" with housing by specially seated "sponge" foam Vinyl gasket.
3. **Specular Aluminum Reflectors** are specially high-polished!—finished by the famed Alzak process! Deliver *maximum* light output from the lamps employed, with "ideal" light distribution! Assembly opens from either side for easiest access, simplified mounting and wiring to terminal block.
4. **Cast-Aluminum Slip-Fitter** accommodates 2" pipe, extending full 13" into housing, quickly secured by special clamp. Allows complete 7° adjustment — providing quick and easy leveling.
5. **New, 2-Way Latch-and-Hinge Assembly** simplifies maintenance. Permits globe to open either way. Stainless steel latches and springs (2 pair on 4-ft. unit, 3 pair on 6-ft. model) maintain *secure* gasket seal!

This new 2FSL luminaire incorporates every development proved superior by Westinghouse—acknowledged to be the nation's foremost authority on modern street-illumination.

ACCURATE, FORTHRIGHT ANALYSIS OF EVERY STREET-LIGHTING PROBLEM. SOUNDEST RECOMMENDATIONS AT LOWEST PRACTICAL COST!

Westinghouse makes scientifically superior luminaires for *every type application!* — that most efficiently utilize *every type of light source!*

Westinghouse Lighting Specialists, therefore, *always* recommend *only the best possible system!* — *for each specific street-lighting situation!* — *consistent with the lowest possible costs that are practical today!* J-94411

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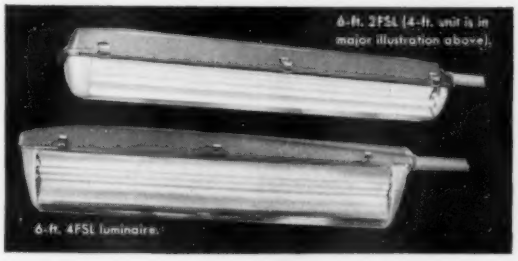

"WE'RE SAVING THE TAXPAYERS' MONEY USING THIS D4"

Elmer H. Weimer, Construction Engineer, City of Lodi, California

Big enough to do many municipal earthmoving jobs well and small enough to provide maximum economy and mobility, this Caterpillar D4 Tractor with No. 4A Bulldozer delivers money-saving performance for the City of Lodi.

THE City of Lodi finds many uses for this CAT* D4 Tractor with No. 4A Bulldozer. Here it's working on a sanitary sewer interceptor line 2¼ miles long. Typical production: backfilling a trench 3 feet wide and 8½ feet deep, it filled 800 feet of ditch in 1½ hours. Its other jobs include removing overburden, pulling trees and clearing areas.

"Because of the great range of work it can do, our D4 is one of the handiest machines we have," says Elmer Weimer. "Our operators like to run it. And operating expense is very low. Actually, we're saving the taxpayers' money with such modern, up-to-date equipment. We feel our D4 has paid for itself. We've done a lot of work with it and it's still full of pep."

Ruggedly built to *work* day after day in tough going, the D4 delivers 63 HP at the flywheel. Its dependable 4-cycle diesel engine reduces maintenance to a minimum. The fuel system requires no adjusting. And operation is economical. You can use low-cost No. 2 furnace oil for fuel without fouling.

For a handy machine for your municipality's earthmoving work, check the advantages of the D4. It's big enough to do many jobs well—small enough to give you maximum economy and mobility. Your Caterpillar Dealer backs it with prompt service and parts you can trust. He'll be glad to show you with actual figures how it can save your taxpayers' money!

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

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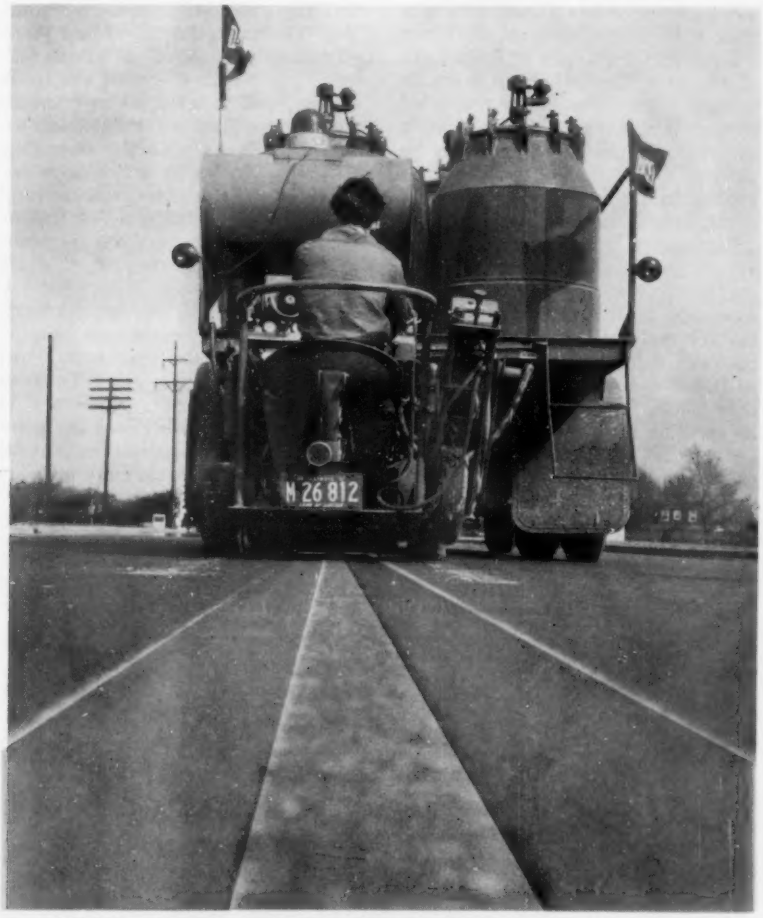
NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

PUBLIC WORKS Magazine
Vol. 88, No. 6, June 1957

SPECIAL TRUCK CUTS COOK COUNTY'S PAVEMENT STRIPING COSTS

PHIL HIRSCH

A NEW TRUCK, specially designed to lay down roadway lane stripes, is cutting costs, and improving the quality of the job, for the Cook County (Ill.) highway department. The unit consists basically of a White 3000 series truck with a large platform at the rear of the COE-type cab. On this are carried three paint storage tanks, together with an air compressor and storage bin for reflectorized beads. The truck tows a marker trailer containing four paint guns and a second storage bin for reflectorized beads. Three bead dispensers are located immediately behind the paint guns. Cost of the truck and trailer, including tanks and other equipment, came to $20,250. Supplier was the M-B Corporation, New Holstein, Wisc.



● MARKING unit owned by Cook County can place as many as four lane stripes at one time. Speeding up work permits striping twice as many miles of pavement a day.

A major advantage of the new unit is its ability to stripe far more pavement per day than the equipment formerly used. The striping crew is now able to stripe twice as many miles of pavement as was possible before, according to Lawrence Mariotti, Superintendent of the Cook County sign shop, who has overall charge of the work. Part of the saving stems from the increased speed of the new unit, which averages 8 to 10 miles an hour when engaged in striping operations. Also, any type of pavement within the county can be completely striped in one pass of the truck.

Basically, three types of striping pattern are employed by Cook County. On standard two-lane roads, a continuous white line is painted down the center of the pavement. On four-lane roads with unlimited access, a double yellow line runs down the center and dashed white stripes separate lanes running in the same direction. These stripes, in the case of blacktopped surfaces, consist of an 18-ft. paint dash, followed by a 36-ft. space. On concrete roads, a 36-ft. black-painted dash follows the 18-ft. white-painted dash. On divided highways, which may be either blacktop or concrete, similar lane separations are used. In all cases, width of the stripe or dash is six ins.

The old marker could handle a conventional two-lane road in one pass, except for areas in which no-passing zones had to be painted. The no-passing zone designation consists of the white center stripe with a yellow line on each side. In such a situation, a double pass was necessary. The truck required three passes, usually, to cover either conventional four-lane roads or half of a divided expressway containing three or four lanes running in one direction. The new truck has 10-ft.

● **TRAILER has speaker-microphone permitting two-way driver-painter talks.**

outriggers, ample for straddling the widest lanes currently in use. This feature, together with the four guns and increased striping speed, enabled the crew to paint up to 30 miles of pavement per day during 1956, the first year the new unit was in service. The maximum for previous years was only about 15 miles per day.

Cost of the labor involved in striping comes to approximately $150 per day. This comprises the wages of three drivers, four laborers, and the painter who sits in the marker trailer and operates the guns. One driver operates the striping truck, another operates a pickup truck that is used to lay down rubber warning markers ahead of the crew, and the third drives a pickup truck that recovers the markers when the paint has dried, 20 to 40 minutes after application. There are two laborers on each of the two pickup trucks. Cost of the paint is $3 a gallon. Approximately 20 gallons are used per mile (6 to 7 gals. when dashed stripes are being painted).

Supt. Mariotti believes that the new truck will cut average striping costs per mile approximately 15 percent below the figure for 1955, when the crew striped seven miles of pavement per day on the average. The cost was $150 plus $3 x 20 x 7, a total of $570, or $81.43 per mile. Last year, with the new truck in service for the first time, the crew averaged 15 miles per day and costs ($150 plus $3 x 20 x 15) averaged $70 per mile. This year, the average should rise to at least 20 miles per day, because personnel are more adept at operating the new truck. Thus, costs per mile should drop to approximately $67.50.

The new truck has three storage tanks—two of them holding 250 gallons each, the third 150 gallons. The county's previous truck had one 180-gal. tank. Formerly, if two colors were required on a road section, the crew would have to return to the sign shop after laying down the first color; empty, clean, and refill the single tank on their rig; and then go back and finish the job. As much as an hour might be consumed on each leg of this shuttle. Another hour usually was required to empty and clean the tank. The latter task involved filling the tank with solvent and brushing the inside surface down with a stiff brush. Since the striping crew can now take up to three different colors with them, travel time is reduced.

Because of the new truck's tilt-cab design, it is much easier for the driver to keep his vehicle aligned, and the painter has less difficulty putting down a stripe that runs straight and true. To assure a straight stripe, the driver lines his vehicle up visually with a reference point on the road. Aiding him is a stick that protrudes vertically from a boom approximately 12 ft. in front of the cab. The reference point is usually the previously painted stripe. Where new construction is involved, the pavement joint may be used, or a line of paint spots may be applied to the roadway, several feet apart, before the striping begins.

Essentially, the same alinement system was used when the old truck was in service. However, the driver was some 20 ft. behind the sighting marker and his line of sight to the roadway reference point was about 40 ft. On the new truck, since he is only 12 ft. from the sighting stick, he can line up his vehicle more accurately as the reference point is only about 20 ft. away.

Paint is now applied much more uniformly, also. Largely, this is because of the heavy-duty Ingersoll-Rand gyroflow (pistonless) air compressor, rated at 125 cfm, which is installed on the back of the White truck. Each of the paint guns requires a pressure of 90 psi. at the nozzle and takes about 11.5 cfm. The compressor also maintains a 30 psi. pressure in each of the three paint storage tanks, and supplies the small air motors that drive the paddle agitators in these tanks. Compressor capacity is enough to take care of these demands and leave an ample reserve. A 100-hp. Continental gasoline engine drives the compressor.

The new unit also makes it much easier to dispense the reflectorized beads that, for several years, have been used by Cook County in all pavement striping work. The two hoppers that have been installed accommodate 1,200 pounds of beads; and the dispensing mechanism is much improved, insuring complete coverage of the stripe.

The task of filling the storage tanks at the beginning of each day's striping operations, and of afterward emptying and cleaning them and the guns, also has been simplified. The tanks are filled and emptied with the aid of a Viking 20-gpm. pump that works off the truck engine, and is installed underneath the storage platform. Paint is drawn into the tanks directly from the 55-gallon drums in which it is received from the manufacturer, and is emptied into the same or similar containers. Hoses for both purposes are provided with the pump.

A five-gallon container of solvent is installed on the storage platform. This container is connected by piping to each of the four paint guns through a three-way valve. To clean each gun, it is only necessary to move a lever which closes the paint supply-line and opens the solvent pressure-line. The cleaning solution runs through each gun under pressure, and in approximately a minute removes the encrusted paint.

● **MARKER boom improvement simplifies the job of laying down a straight line.**

FINANCING

Suburban Sewer Extensions

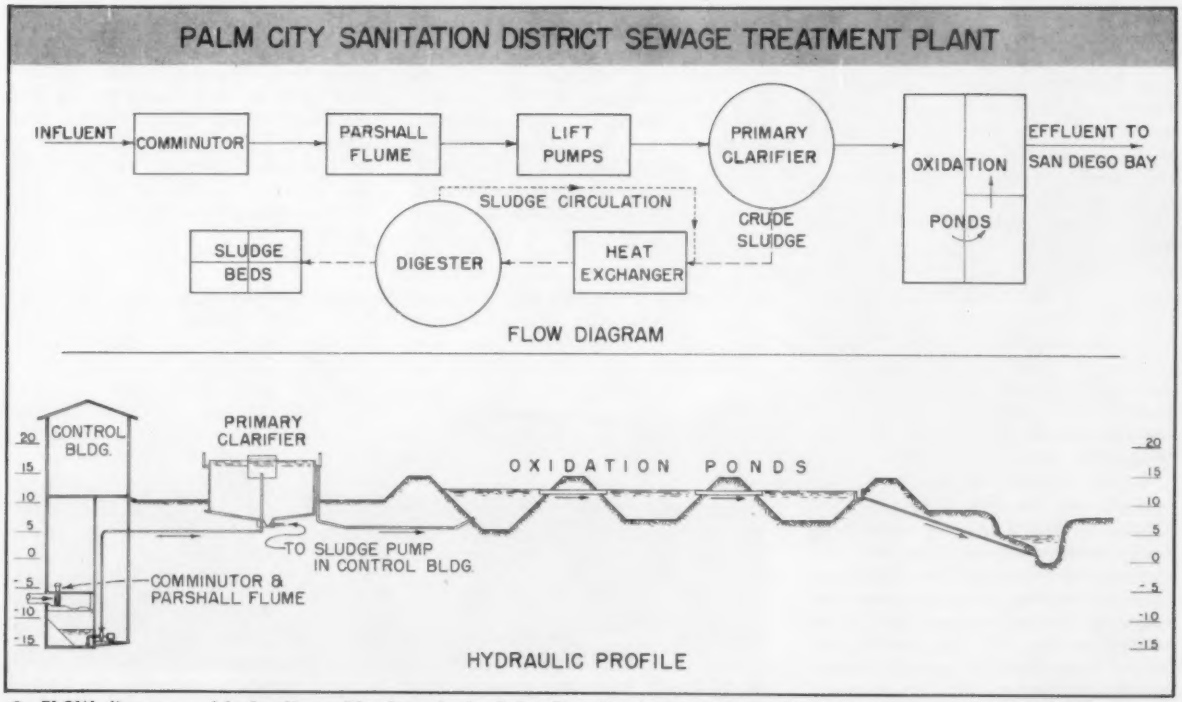
WARREN A. BARNEY,
Chief, Division of Engineering, Department of Public Works, San Diego County, California

RAPID GROWTH OF suburban areas of San Diego County, Calif., had, by 1952, created a serious sanitary problem in the unincorporated area lying south of San Diego Bay. A district, known as the Palm City Sanitation District, was formed in order to have a governmental entity with the power to construct and operate a sanitary sewer system. After preliminary engineering studies had been made and cost estimates had been prepared, the difficulty of financing the necessary construction became apparent. The area was dependent entirely upon septic tanks, and a complete system consisting of a sewage treatment plant, trunk sewers and collection sewers estimated to cost $810,000 was found to be necessary. The assessed valuation of the district at that time was $2,400,000. The estimated cost of the sewer system, therefore, amounted to almost 34 percent of the assessed worth of the district. Assuming a 20-year equal annual payment bond issue at four percent interest, the tax rate for the first year for bond retirement and interest, exclusive of operating costs, would have been $3.04 per each $100 worth of assessed value.

Realizing the impracticality of attempting to obtain a favorable vote on a bond issue which would result in such a tax rate, a study of all possible means of financing the project was made by the San Diego County Department of Public Works. The study resulted in a recommendation to amend the State Sanitary District Act so as to permit the establishment of connection fees and charge for sewer service, and to permit the collection of such charges by the County Tax Collector. The amendment was approved by the California State Legislature and became effective on May 23, 1953. Estimates of the revenue which would be derived from the fees and charges which could then be established, indicated that it would be possible to devise a plan of financing which would result in a probable maximum tax rate, including operating costs, of $1.20 per each $100 of assessed value. An $810,000 bond issue based upon the new legislation was therefore proposed and was approved by a very large majority.

The Treatment Plant

The sewage treatment plant, designed for complete treatment for a connected population of 10,000 persons, includes a mechanical shred-



● **FLOW diagram and hydraulic profile through the Palm City Sanitation District plant. Design provides for 10,000 people.**

der; raw sewage lift pumps; a primary clarifier with sufficient capacity for 2.25 hours detention at average flow conditions; a sludge digester with a capacity of two cubic feet per capita; three oxidation ponds with a combined surface area of 11.5 acres; sludge drying beds with an area equal to one square foot per capita; a waste gas burner; a control building; roads; fencing; and other necessary appurtenances.

The treated sewage is discharged to San Diego Bay. The manner and timing of the discharge is unique in this area. There are certain commercial users of the waters of San Diego Bay who withdraw water from the bay adjacent to the point of the discharge of the treatment plant effluent. This withdrawal of water occurs only when the tidal flow is above a certain critical elevation. This elevation is established by agreement between the commercial users and the sanitation district, with the district agreeing to discharge effluent only at certain stages of the tidal flow.

● **THIS is the primary clarifier; the oxidation pond is in the background.**

The trunk sewer and sewage collection system consist of 92,665 linear feet of 8-in. to 18-in. pipe. Because of the fact that much of the construction was done at or below mean sea level, water was one of the problems of the contractor. A well-point system was used with success. The system also includes two raw sewage lift stations, together with 2,947 feet of 6-in. force main.

As the construction was being accomplished, the San Diego County Board of Supervisors adopted the ordinances establishing the fees and charges to be made. The financing plan which had been recommended required the total annual cost of the project to be met with funds collected from all of the property owners in accordance with the assumed benefit each would derive from the sewer system. This was accomplished by requiring all properties which abut directly on the sewers to pay, when connected, three charges: a general tax based on the assessed valuation of the property; a connection fee due when the actual connection to the sewer is made; and a sewer service or use charge.

Charges and Payments

All of those properties which do not abut directly on the sewers pay only the general tax. The tax levied on these properties is justified by the fact that all properties in the district have certain capacity rights in the trunk sewer system and treatment plant. Such properties, not abutting directly on the sewers will never be subject to the connection charge since, when the need arises, they must pay independently the costs of the extension of the sewer system to serve their property. When such extension of the system is completed and connection to the sewer is made, the property will be liable for the service charge.

The connection fee is payable at the time each home or business establishment is actually connected to the sewer. Payment may be made in a lump sum or spread over ten years at the option of the owner. This fee has been established at $200 and is based upon the assumed benefit to the property resulting from the construction of the sewer system. The same fee applies to each new connection made to the sewers installed by bond issue funds regardless of the front footage involved and will always be in force. The amount of the connection fee is calculated to be sufficient eventually to repay to the district the cost of the sewer lines. It should be emphasized that the connection fee is a payment made for the right to connect a property to the sewer and is not a charge for making the physical connection. A service charge of $18 per year has been established for each using residence which is connected to the sewer, with higher fees being charged to commercial and industrial users. This charge will cover maintenance and operating costs, plus a portion of the cost of the system.

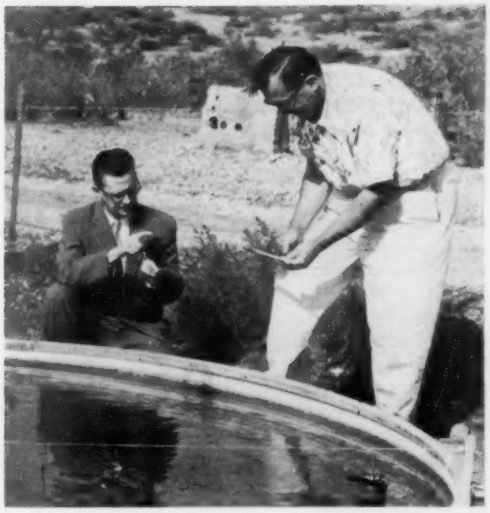
A general tax is levied upon all property in the district, occupied or unoccupied, connected or not connected, on the basis of assessed valuation. Funds collected from the general tax are applied toward those costs not covered by the connection fees and service charges collected during a particular year. This tax on all property is believed to be equitable, since all property will derive certain benefits from the system, whether actual or latent.

It is always of particular interest in any new procedure to see if the results are as anticipated. In the case of the Palm City plan, our estimates of revenue were somewhat conservative with the result that the tax rate in the district was lower than had been predicted.

The system was first placed in operation in May, 1956. As of January 1, 1957, there were enough connections to produce a revenue for this fiscal year of $18,000. The service charges will produce during this year, an additional $12,600. The balance of the annual cost requires a tax rate of $0.93 per each $100 of assessed valuation as compared with the estimated tax rate of $1.20. The increased building activity and property development within the district, due in large measure to the existence of the sewer system, has produced an increase of 39.5 percent in the total assessed valuation of the district, tending to reduce the tax rate faster than had been anticipated.

● **PRIMARY treatment group is shown in this illustration, including the Central Building, the digester in the left background and the primary clarifier at right.**

Evaporation Control as a Means of Water Conservation



● THE authors are shown beside a test tank.

B. W. BEADLE
and
ROBERT R. CRUSE,
Southwest Research Institute,
San Antonio, Texas

THERE ARE several methods of water conservation, which include recycling, repurification and reuse; and, in rural areas, soil conservation techniques such as small reservoirs and catch basins, cover crops, contour plowing and other anti-erosion methods. Control of evaporation offers a major conservation possibility, and can be accomplished in several ways.

In hot, arid climates evaporation from reservoirs can represent losses of up to ten vertical feet of water depth per year. Studies at Lincoln, Nebraska, running from 1895 to 1910[1], showed that the daily evaporation during the period from April to October was in excess of the rainfall.

Methods of reservoir evaporation control involve reduction of the exposed surface of the reservoir, or moderation of conditions which favor or effect evaporation, or both. Several basic methods of reducing evaporation losses are available. These include:

1. Construction of reservoirs with maximum average depth, e.g., the selection of deep, narrow canyons as reservoir and dam sites. 2. Concentration of water into single reservoirs. 3. Elimination of marine growths; e.g., water hyacinths, marine weeds, lily pads and willows. 4. Elimination of shallow water areas. 5. Recharge of underground aquifers; or storage of water in underground reservoirs. 6. Wind breaks. 7. Reservoir roofs, floating covers (Bottom and wall sealants for control of seepage losses represent a closely allied measure.) 8. Monomolecular organic films applied to the water surface.

To illustrate the effect of using reservoirs with maximum depth and minimum surface area, the following example is presented.[2]

In West Texas there are located two reservoirs, each with about 60,000 acre-feet storage capacity and only thirty miles apart. At the 60,000 acre-feet level, one reservoir has a surface area of 5300 acres, and an average depth of 11.3 feet, while the other reservoir has an area of only 3580 acres and an average depth of 16.8 feet. At an average operating capacity of 40,000 acre-feet, the difference in surface areas of the two reservoirs is 1275 acres. The average net evaporation loss, after rainfall, in this section of West Texas is about four feet per year. The **difference** in evaporation between the two lakes is, therefore, approximately 5100 acre-feet per year. The difference in evapora-

day.

In the general area of the Southwest, water pads, lilies, water hyacinths, willows, and similar growths in shallows or swamps will transpire into the air from four to five vertical feet of water a year in areas where the growths are fairly heavy. The most practical and permanent method of eliminating this cause of water losses is to clear the area of brush and trees first, and then either deepen the reservoir at the shore to a depth of at least three feet, or raise the bank two or three feet above the normal water level.

Floating roofs or covers for reservoirs have been considered, but have been used more generally to keep out air-borne pollution than to restrict evaporation. For a large reservoir, the cost would be prohibitive and the returns in water savings uneconomical. If the reservoir were used for recreation purposes, this method would greatly restrict its use. Both thin sheet plastics and sheet aluminum have been proposed for this purpose.

The effect of windbreaks is open to some discussion, Many factors, some peculiar to the particular reservoir under consideration, are involved. Several evaporation formulas have been evolved[2]; one of the simpler ones[3] includes the factor $(1 + w/10)$ where w = the wind velocity in miles per hour measured approximately 25 feet above the water surface. Use of this formula would indicate that a drop in wind velocity from six mph to three mph would decrease the factor from 1.6 to 1.3, or 23 percent. The actual location of the reservoir would have much to do with the effects of the windbreaks.

The monomolecular film technique of retarding evaporation is, on a large scale, a fairly recent development. Sustained efforts to develop the large-scale technique utilizing hexadecanol were started in Melbourne, Australia, in 1952, and have subsequently been extended to South Africa, Kenya Colony, and the United States. In this country, studies on the monomolecular film technique have been undertaken by the U. S. Bureau of Reclamation in

Oklahoma; by the State of Illinois, and in Texas by the Southwest Cooperative Committee on Reservoir Evaporation Control, now the Southwest Reservoir Evaporation Research Council. This committee is composed of representatives of municipal water works, water and irrigation districts, river authorities, consulting engineers, chemical companies, and other interested groups or individuals. With the Texas State Board of Water Engineers acting as contracting agency, a study of monomolecular films and their effects on evaporation of water from reservoirs has been under way at Southwest Research Institute, San Antonio, Texas for approximately one year. This discussion will describe in detail the background and present status of the investigation.

Theory of Action of Monomolecular Films

Certain types of organic compounds—fatty acids, fatty amides, fatty alcohols, fatty nitriles and certain other special organic materials are composed of molecules whose structures consist of a hydrophobic portion, such as a long hydrocarbon chain and a hydrophilic portion, such as a hydroxyl, amino, or acid group. Such molecules possess the ability to spread when a material source is placed on a water surface. If the source is adequate, enough molecules of the substance will spread out over the surface to form a closely packed film one molecule thick with the hydrophilic end in the water, and the hydrophobic end above the water. If the packing of the molecules is sufficiently close a reduction in the rate of evaporation of the water under the film is effected. It is necessary to have available an excess of the film forming material over that actually required for complete film formation, usually as solid material stored in a cage or screen raft on the water surface, in order to provide a reserve in case the film is damaged or ruptured. The exact orientation of the molecules in the film is still a subject of some discussion. Langmuir[4] proceeded on the theory that the molecules were more or less rigidly compressed in a monomolecular film, and used this as a basis to determine the size and shape of various molecules which would form the film, or of space "occupied" in the surface.

The property of a surface film of oil to hinder the breaking of waves and thus help protect ships in stormy seas has been known since ancient times. The dancing motions of camphor spreading on a water surface are also familiar. About 1890 it was noted that oily contamination lowers the surface tension of water. In 1917 Langmuir[4] introduced new concepts and techniques into the study of films and utilized these to measure the cross sectional area of the molecules constituting the film. Later Hedestrand in 1924[5] made an unsuccessful attempt to utilize such a film to reduce evaporation of water. The first successful results of the use of a monolayer to reduce evaporation were reported by Langmuir in 1927[6]. The use of hexadecanol gave a 50 percent reduction in the rate of evaporation. The use of an alkyl phenol, or cresol, and mineral oil film was patented in 1939[7], but the process did not appear promising for lakes and reservoirs which were used for recreational purposes and domestic water supplies.

The previously mentioned Australian work is still in progress and results are still inconclusive. A mean reduction of evaporation of about 45 percent in inland Southern Australia has been predicted[8]. Hexadecanol and octadecanol were claimed to be the best evaporation retardants, the relative efficacy varying with the temperature of the water in the reservoir.

On a laboratory scale LaMer and his associates at Columbia University have recently published their studies[9] [10] on the action of fatty acids, esters, and alcohols in reducing evaporation of water. Under the optimum available laboratory conditions, reductions in the rate of evaporation of up to 99.99 percent were achieved. Some recent work on the effect of variation of molecular structure on the film performance has been reported in West Germany[11].

SRI Program

The Southwest Research Institute first became interested in the subject of water evaporation control in July 1954 when Dr. Ian W. Wark of Australia addressed the San Antonio Section of the American Chemical Society on the application of the monomolecular film technique. It was recognized that the process might be of interest to the American Southwest, inasmuch as the drouth conditions had emphasized the importance of water conservation; however, it was felt that conditions existing in Texas might prove to be different from those in Australia, and hence, additional work here would be desirable. As a result of subsequent negotiations the Southwest Cooperative Project on Control of Evaporation from Reservoirs was established. Colonel E. V. Spence, General Manager, Colorado River Municipal Water District, Big Spring, was named Chairman, and Uel Stephens, Manager, Fort Worth Water District, was named Secretary-Treasurer of the sponsoring group. The Texas State Board of Water Engineers agreed to act as the contracting agency for the sponsors.

A review of the first year's work indicates that the method shows a great deal of promise, based on laboratory and small tank work. For general, field, and large-scale applications, there are a number of problems requiring further study, even though the Australian work did not emphasize their importance. These problems have arisen, both

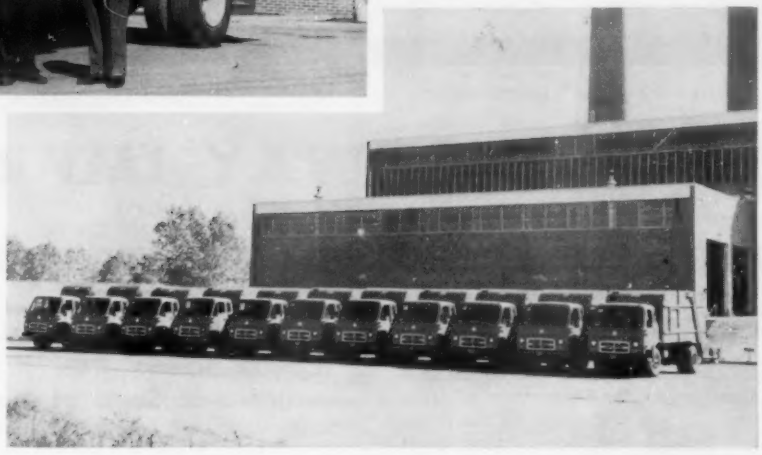
(*Continued on page* 178)

Many Jobs for One Machine

● **CLEANING up around a head wall on an Ohio widening and relocation job.**

THE GRADALL pictured in this photo is working on a road-widening and relocation job involving seven miles of Route 124 southeast of Piketon, Ohio. The machine averaged 60 hours of work each week, doing such diverse jobs as widening excavations, installing pipes and drains, removal of old pavement, shoulder work, sloping, clean-up around headwalls, excavating aprons at driveways and intersections and curb and gutter excavation. Job Superintendent Eddie Massie had this to say about the Gradall: "It's the handiest piece of equipment we have in this type of work. We couldn't get along without it."

● **LARGER collection unit has reduced cost and speeded up work. Here is 20-yd. Heil on IHC truck which handles over 9,000 lbs. of refuse per load. At right is collection fleet at incinerator.**



REFUSE COLLECTION COST CUT . . .

Service Improved

DESPITE higher operating costs and wages, the Public Works Department of Hartford, Conn., has increased its refuse collection service and reduced per ton costs for disposal. Hartford has a population of 183,000 and in the 1955-56 period, refuse collections ranged from 160 to 250 tons per day.

The Sanitation Division of the Public Works Department is organized into three operating units: Refuse Collection; Incinerator and Wastes Disposal; and Street Cleaning. Lyman C. Lovell is director of the division; Henry Giles is Division Sanitary Engineer; and Don DiCioccio is Equipment Maintenance Superintendent. For collection purposes, there are four collection routes, each with a foreman in charge. Alfred E. Moylan and Richard F. DeLisa are supervisors of refuse collection.

Until early in 1954, each route was worked with six trucks—five 15-yard refuse packer trucks and one open truck. Each route had 26 to 32 men assigned to it. Collections ranged from 160 to 215 tons daily. The following year, this increased to 180 to 225 tons. To care for the increased load, six 16-yd. trucks were added to the older equipment. Each truck made four, and sometimes five, trips to the incinerator or disposal area. The first step, taken in 1954, to reduce disposal costs was a program to insure that each unit was fully loaded before it went to the disposal point. This reduced the number of trips per truck to three or four.

During July, 1956, the city replaced 25 of their old collection trucks with 16 new 20-yard units. Each route now has four of the 20-yard trucks and one of the older 16-yd. units in reserve. At present, 26 men are assigned to each route and service has been improved in that emptied containers are being returned to the back yards. Previously these had been left at the curb, though it has always been the practice to bring the filled containers from the rear of the residence to the curb for emptying. Return of the containers results in a far better street appearance.

Each route is normally organized into four truck crews with a driver and five men working directly with the truck, bringing out the filled containers and returning them. Each truck unit makes two trips to the disposal area and frequently three trips. The 20-yd. units are averaging over 9,000 pounds per load of combustible refuse. Studies made prior to the purchase of the new trucks showed that 8-yd. open type trucks averaged less than 4,000 lbs. per load; the 15-yd. units that were nine years old averaged 5,000 lbs. per load; the 15-yd. units five years old averaged 6,000 lbs. per load; and the two-year old 16-yd. units, which have been retained as spares, averaged 7,000 lbs. per load.

Since last July, each 20-yd. unit has carried 27,000 to 30,000 lbs. of combustible refuse per day, or over 5,000 lbs. per man per day. The city has cut the number of workers assigned to the refuse collection routes, not including foremen and supervisory personnel, from 120 to 104. On the purchase of the 16 new 20-yd. units, the city turned in 25 old trucks. This has improved the maintenance picture and the city has found it is much easier to store the 16 new trucks than it was the 25 old trucks.

In the 1954-55 period, the cost of refuse collection per ton, including truck operation, maintenance, insurance and depreciation, was $10.72. In 1955-56, it was $9.66 per ton. Costs for the 1956-57 period are not yet available; but it is believed that the overall cost will again be decreased. This reduction in cost has been accomplished despite an increase in wages of $6. per man per week, higher costs for gasoline, oil and insurance and the additional service of returning the emptied containers to the backyards.

SALT-FILLED VERTICAL DRAINS

FOR HIGHWAY IMPROVEMENT

The work described in this article took place in Boone County, Illinois, from 1954 to the present time. The writer was Supt. of Highways during this period.

NEAL H. FRANK

Davis Sand & Gravel Company,

Belvidere, Illinois

A VERTICAL drain, as referred to in this article, is a vertical hole punched by a pneumatic drill to a depth below the frost plane, or from three to five feet deep. At the present time it has been found most feasible to create the hole by punching. It was desired to punch a 3-inch hole. However, we have accomplished up to 2 ins. to date. This was done by taking the cutter head off the drill steel and experimenting with various sizes and shapes of welded knobs. In the absence of established data we are trying to arrive empirically at the spacing and location of holes to render the most good.

The experience of punching vertical drain holes has been an extremely interesting one over the past four years. By watching the resistance offered to drilling, information has been gathered as to sub-base conditions. All holes punched are filled with rock salt. This is done to obtain a frost free hole that can operate twenty-four hours a day without interruption. About two pounds of salt is applied to each hole.

The most interesting feature of our hole punching operation is the theory and reason for its being done.

● **ROW OF HOLES along center line of a road that has already suffered from trapped water, causing surface cracking. Water is beginning to flow from holes.**

We more or less fell into the experience. In attempting to do something about a seasonal softening of our roads we tried the punched hole. The farther we went, the more we were stimulated to acquire all available knowledge on the subject. Therefore, that which is put forward here is a compilation of what we have experienced first hand and what we have read to substantiate our findings.

Trapped Water

The problem is one of trapped water. The source of this water is the subject of much speculation. It

● **UPSLOPE view shows water accumulating at change of grade and flowing up through cracks**

was felt that water in sufficient quantity in a base to cause softening came there by percolation and capillary activity. Hence the expression, "With a good roof a dry house." To offset the accumulation of this water, we seal cracks regularly and build bases as free of capillary potential as possible. Base thicknesses have been predicated on soils analyses. Soil densities have been effected and controlled as accurately as possible. This seems to answer the question for a while; but, after a few years, trouble starts to develop. We then blame our maintenance forces and the misuse of the road by heavy loads. Finally we resurface or reconstruct. This, however, does not satisfy the suspicion of our lack

of knowledge. When we see a road supporting any load, and any number of them, in the summer time, and then see that same road fail under a light load in the springtime, we cannot deceive ourselves much longer.

We believe the source of water that is giving us so much trouble comes as a result of thermal activity. It is difficult to believe because it cannot be seen by the physical eye, though we can see examples of it around us and project them to a road condition. Take a bottle of cold milk from the refrigerator and let it set for a few minutes in a warm room and we see moisture form on the outside of the bottle. Also, consider the window pane in cold weather and the condensation of moisture on the inside. It is not difficult to see that if the pane of glass in a horizontal position represents our road surface and our road sub-surface represents the room with air present, we can see moisture forming under the surface each time the essential temperature differential is present. Therefore, it is believed, our spring problems start from activity initiated in the late fall and early winter. From what depth this water vapor is pulled we do not know. We do know, however, that the percentage of ice in a frozen zone varies with the depth. I believe it can be seen that once this ice starts to form in the early winter, there is little chance for percolation water to enter the base from the top down. I do not believe it is as simple as this: however, we must also consider the activity of water as it goes from its most dense condition at 39.4°F to its condition of ice at a sub-zero temperature. Involved in this difference

● DRILL rig used to make the vertical drains. This road was treated prior to blacktopping.

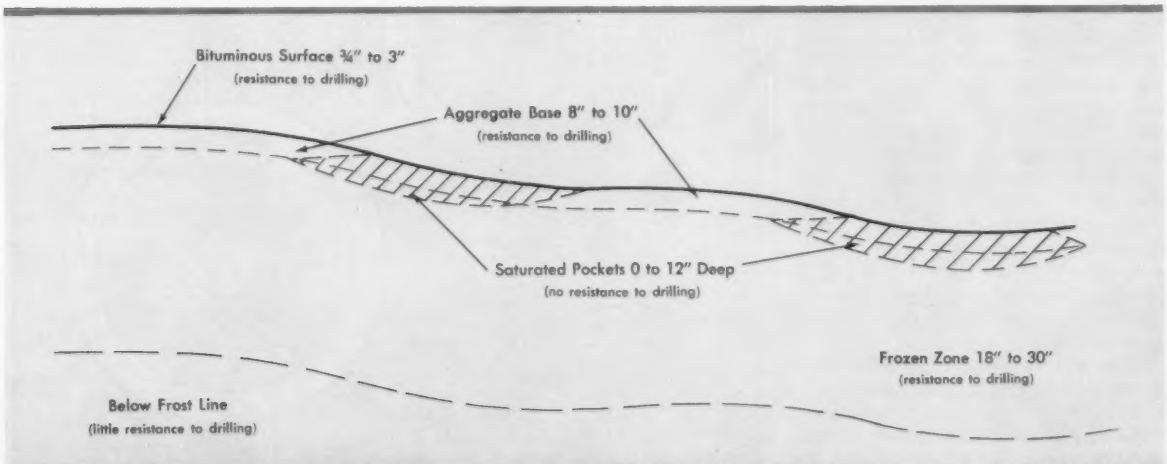
is a changing of volume of the water and ice. When the water freezes to ice it expands and continues to do so until it reaches a temperature of +4°F. While it is doing this, it is pushing aside base and sub-base particles. As the temperature further drops beyond +4°F. the ice contracts. When this happens it can be presumed that cavities are left in the base for more water to enter.

We come, however, to the approach of spring and posted roads. On a warm day we see water forming from cracks in the surface. From then on the extent of spring damage is largely dependent upon the freeze-thaw cycles. Due to road surfaces absorbing the heat of the sun more readily than do the shoulders, the area immediately under the road surface thaws first. This melting water cannot go down nor drain out through the shoulders due to frost. It can only drain out through the top. As this water forms under the surface it builds to a point where it begins to flow. It flows towards the sides of the "troughed" road bed and then gravitational forces carry it under the surface along the road profile. As more and more water flows in this manner, the low areas of the profile become saturated over their width and softening develops. Trouble spots most often occur at changes of grade or at any obstruction to this undersurface flow.

Relieving Trapped Water

Our theory, then, with the vertical punched hole, was to drain this trapped water down through the frozen zone. The salt was added to the hole to permit this drainage continuously; our reckoning being to drain the moisture as it formed. We drilled in the low spots and noticed that water would flow out of the hole at night and would be depressed in the hole during the day time. We found that if holes were drilled only in the low spots, more and more holes had to be drilled to take care of the ever increasing volumes of water coming down from upslope. Therefore, we began to drill holes up the slopes. We drilled them at various distances apart, from 10 ft. to 100 ft. By drilling these holes continuously along the road and observing the resistance to drilling, we could see what condition we had in the sub-surface. It can best be explained by the sketch below.

The question arises as to how long the salt will remain in the hole. We can only report our experience that holes drilled in 1954 are still active. Also, how many holes are required and what size? We tried for a 3-in. hole but could only get 2-in. The number depends upon the condition. A steeper road slope will require more holes. Working with an area that showed the tell-tale



● SPRINGTIME road section is shown in typical profile with saturated pockets which are treated as described in text.

● AS DRILL enters water saturated area in base, flow relieves pressure.

cracks of destruction, we have drilled holes half-way along its length and observed. Where we drilled, the cracks remained in a static condition. Where we did not drill the road heaved and broke out. By watching for the first stages of cracking, and then drilling, we have arrested the process of destruction.

Areas are under observation where roadbeds have been drilled prior to bituminous surfacing. Results have been excellent thus far. We note during the winter that these holes are working because they remain in position while the rest of the surface heaves with the frost.

This past year we experimented with three separate roads by drilling along the edges of the blacktop throughout their length with holes placed 5 and 10 ft. apart. It has been observed this spring that, as yet we have experienced no edge checking and the holes are draining water.

It will take time to solidify conclusions. However, we have done enough to be sure that it is a field in which more can be learned about the phenomena of spring breakup.

I wish to express grateful thanks to Gordon Hess of Morton Salt Co. who was unfailing in his support of our program.

PHOTOGRAMMETRY SPEEDS COMPLETION OF TRUNK SEWER LINE

KENNETH A. THOMPSON

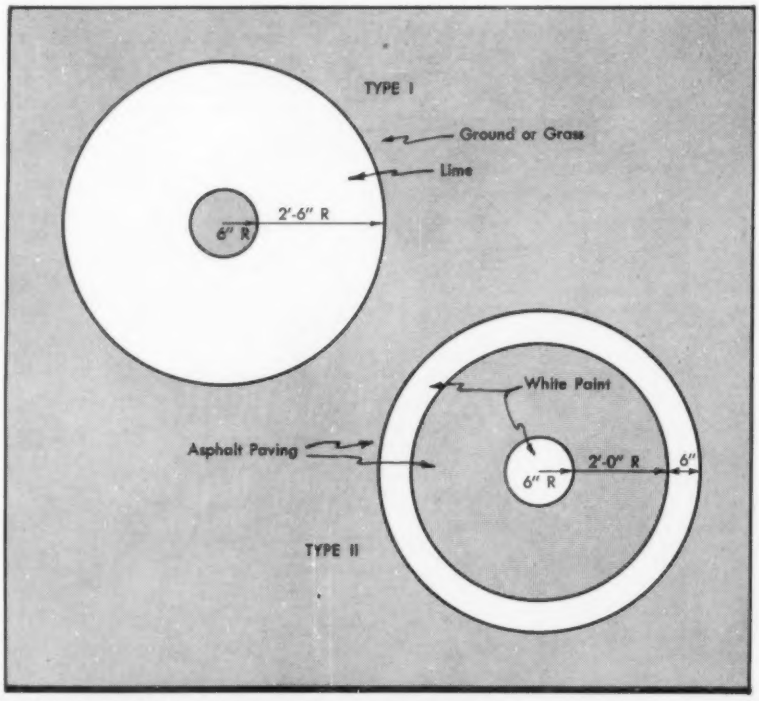
City Engineer,
Roseville, Calif.

PHOTOGRAMMETRY was used for cut sheets on design to speed completion of the first three units of a $497,000 trunk line sewer project. In one year this project went from a citizens committee to completion of construction of $300,000 of sewers. Although photogrammetry has been used many times for preliminary plans this is believed to be the first time it has been used directly for construction plans on a major job for sewers. The job itself consisted of 15,794 ft. of concrete rubber gasket pipe ranging in size from 39 inches to 18 inches in diameter; and 2642 feet of 15-inch and 12-in. diameter clay pipe.

Contour maps were made on the scale of 1″ = 50′ with 1′ contour intervals from stereophotos. The entire city and surrounding area was photographed and contouring done for 900-foot wide strips covering the areas in which the sewers were planned.

Prior to photographing, 5-ft. diameter circles with 1-ft. diameter bulls eyes were painted on section corners, quarter corners and other random points. To aid in control a high altitude photograph was taken to show the whole area in one plat.

The entire area was set up on a coordinate system. Bench levels were run to all of the targets and to intermediate points which were designated by coordinates. To save time many of the intermediate points were run by stadia for Northing and Easting coordinates. All vertical control was run by closed circuit levels for the dual



● BULLSEYES and circles used. Type I was in rural areas, Type II on pavement.

purpose of establishing benchmarks and furnishing vertical control for the contouring.

The trunk lines in general paralleled the creek bed and only a 900-foot strip centerlining the proposed line was contoured. The maps showed the locations of large trees and fence lines accurately which was a considerable help in locating the final line.

Few recorded surveys had ever been made in much of the area traversed by the sewer line. Descriptions had been made of the properties by metes and bounds, and some of the fences were 30 feet to 40 feet from actual boundary lines. Some property lines were in active dispute. To avoid any difficulties all easement lines were described in relation to section corners. In these descriptions our coordinate system facilitated the description problem greatly.

Cut sheets were made by plotting the course of the sewer lines on the contour maps and plotting the contour line intercept points on profile paper. Grade lines were then established. When the grade line was actually staked, records were kept and plotted back on the cut sheets. In only one area did a significant error show up. This was an error which showed the actual ground level to be two feet higher than was shown on the contour map. Fortunately however, this particular error was in a fill section of county road, 1200 feet long. It was corrected by relocating the line alongside of the road where we originally wanted the line but did not place it there because we didn't think we had sufficient cover. The additional two feet corrected that aspect.

The remaining two units of the trunk line plan are now being designed also using the same method. It is expected that they will be let to bid by late summer. The city also plans to utilize the aerial maps for a design of a curb and gutter project this fall. Preliminary work has already been started.

Our experience here would seem to indicate that considerable time and effort can be saved by use of aerial mapping and topography. Certainly to a two-man engineering staff, such as we have in Roseville, it provides a crutch that would almost be impossible to get along without.

Mapping was done by Pacific Air Industries of Los Angeles, California; design plans by Wilsey & Ham of Millbrae, California and ground control and design checking by the city staff.

● **COMPOSITE** of three aerial photographs shows a portion of the course of the trunk sewer. Circles indicate location of 5-ft. bullseyes which were painted at section corners and other points. Bench levels were run to all of these targets.

BETTER CONDITIONING SOLVES

FACED with a shortage of water during the critical summer months, and bothered by tastes and odors, Monticello, N. Y., laid new mains, increased its elevated storage capacity and improved the operation of its water treatment plant. The total cost of the improvements was $330,000. Operating costs will be reduced materially through lower chemical costs, reduction in filter wash water and use of electric instead of diesel power for driving the pumps.

Monticello is an important resort village in the Catskills. The winter population of about 5,000 is largely increased in the summer months. Over summer holidays and long week-ends, peak population may reach nearly 20,000. Water is obtained from Kiamesha Lake, about two miles distant. Prior to the present improvements, the water was pumped to the village through a 12-in. main. There were two 250,000 gal. standpipes, but the elevation of these was not sufficient to serve many homes in the newer and higher areas of the village; and on days of heavy demand there was dangerously little water available for fire protection.

Plans for improvements to the supply line and distribution system included a new 14-in. mechanical joint cement lined cast iron main from the Lake pumping Station to the edge of the village, about 9440 ft., and a 12-in, main 6,000 ft. thence to a new 500,000-gal. storage tank. Connections were also made to the existing distribution system and 5,000 ft. of new 8-in. mains were laid to replace 4 and 6-in. lines, some of which had been in service for nearly 60 years. Provision was also made for cleaning some of the old mains.

New High Service Area

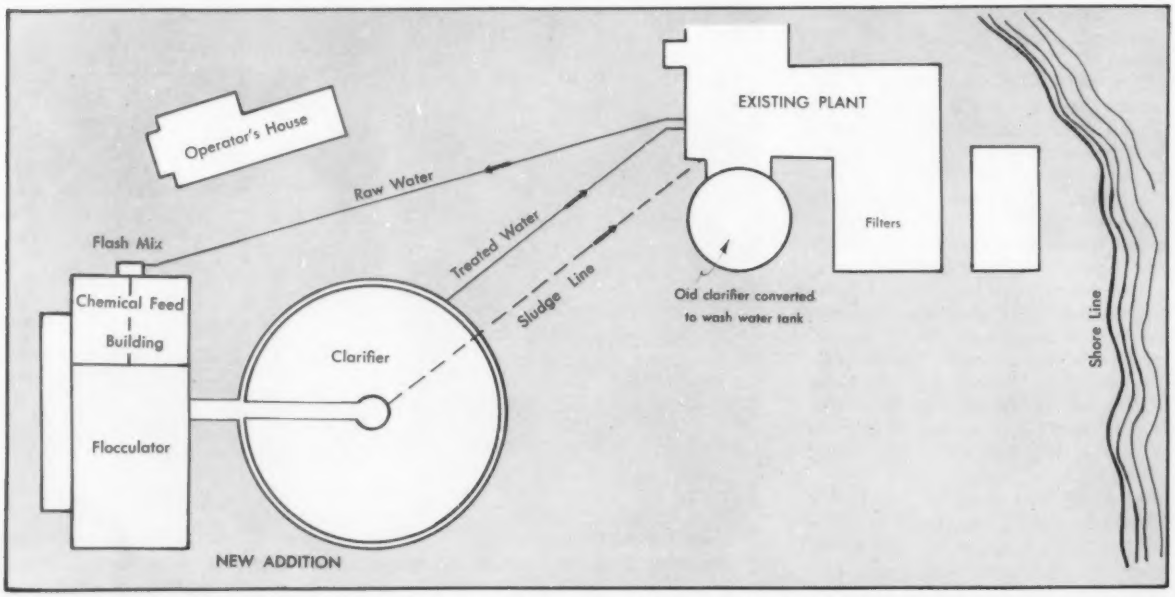
Since the water surface in the new elevated storage tank was higher than that in the old standpipes, a booster station had to be installed and the village divided into high and low pressure areas. This resulted in adequate pressures in many of the higher areas of the village for the first time. This arrangement was desirable, but it was also necessary because the old 12-in. line from the Lake to the village was class 150 pipe, whereas the difference in elevation between the pump house and top of storage was 280 ft., leaving a small margin of safety.

The bid price on the 14-in. pipe was $10.00 per ft., and on the 12-in. $8.50 per foot. The 14-in. valves in place cost $350 each; the 12-in. $270; and 6-in. $105.

The safe yield of Kiamesha Lake is estimated at 365 million gallons a year. In 1954, Monticello pumped 268 mg and other users took an estimated 60 mg. However, it is not anticipated that actual Monticello usage will increase. In 1954, 32 mg were used for backwashing the filters, whereas the new treatment plant used only about one-third as much in 1956. The amount saved is equal to the expected increase of water use over the next ten years. Also, it is possible to divert a nearby brook into the lake, if this should become necessary.

The Treatment Plant

The water from Kiamesha Lake is typical Catskill surface water. It is soft, low in alkalinity, with small seasonal turbidity and subject to seasonal taste and odor problems. On coagulation, it forms a light and feathery floc which settles slowly. The upflow type of clarifier is not well suited to treating this water and the unit installed in 1950, when operated at or near its rated capacity, carried over large amounts of floc to the filters, resulting in exceedingly high wash



● **PLANT layout is shown here. Kiamesha Lake is at the extreme right; the old plant nearby and the new plant at the left.**

water requirements. Also, coagulant dosages had to be high, resulting in heavy alum, lime and, at times, carbon use.

Plans for the new treatment plant included a flash mixer, a flocculating compartment and a circular clarifier, all constructed as a unit; conversion of the upflow clarifier to give added clear well capacity; and raising the filter walls 2 ft. and installing Palmer surface wash equipment. There are four circular filters, each 13 ft. in diameter, with a total area of 530 sq. ft.

The new conditioning unit was designed to treat 2 mgd. The flash mixer compartment is 3 ft. by 3 ft. The flocculation compartment is 50 by 14½ ft., providing a detention of about 45 minutes. The settling tank is 55 ft. in diameter with 13 ft. sidewater depth, and a detention period of just under 3 hours. All equipment was furnished by Dorr-Oliver. Because of the low winter temperatures, an ice hood was provided to protect the center mechanism. This hood keeps the ice clear to about 10° above zero. Since the plant is operated only 12 to 16 hours a day in winter, in extreme weather (20° below zero) it is necessary to break the unit free in the morning. Modifications are being planned to eliminate ice troubles even in the coldest weather. In summer, the plant is operated, over a 10-week period, 20 hours a day. There is only one stop and one start each day.

Chemical storage is provided by a cinder block building over the flocculation tank. The chemical feed machines are housed in an adjoining brick building over the flash mix unit at the inlet end of the flocculator.

Chemical Savings

The budget, based on previous experience, allowed $4,400 for chemicals for 1956—$2200 for copper sulphate; $1300 for alum; $400 for lime; and $500 for chlorine. It was not necessary to use any copper sulphate; the alum used cost $792, the lime $180 and the chlorine $470. Standard alum dosage was 1 grain per gallon and of lime ½ gpg—markedly less than was necessary with the previous plant. Though the 1956 savings amounted to $2958, it is possible that copper sulphate will be needed from time to time in the future. The annual chemical savings by reason of the new plant are conservatively estimated at $2000.

Another important source of savings comes from the marked reduction in wash water required. This ranged as high as 12 percent and amounted to as much as 180,000 gpd at times, whereas with the new plant it was well under 4 percent at all times during 1956. In fact, during a part of the year filtration is scarcely necessary, since a high degree of clarification is obtained by coagulation and settling. There have been no taste and odor complaints since the new plant was placed in operation.

The general contract for the treatment plant amounted to $63,000. Fluoridation of the water was approved by referendum and started in Jan. 1957, using Wallace & Tiernan equipment.

To allow continuous operation of the treatment plant, if desired, the pumps were geared down from 1400 gpm to 1050 gpm. At this rate, the plant is operated at a rate sufficient to keep the standpipes filled for 20 hours a day during 10 weeks in the summer and for 12 to 16 hours a day in the winter. No raise in water rates has been required and the water revenue is sufficient to pay operation and amortization costs.

Another saving was accomplished by adopting electric drive and using the old diesel engine for standby. A saving of about $2,000 per year is expected, but part of this will be due to the reduction in the volume of wash water required. About 25 mg less was used in 1956 than in the immediately preceding years. All of this had to be handled by the lift pump, and then the dirty wash water had to be pumped to the sewer system.

The work was planned and carried out by Olney Borden, consulting engineer of Liberty, New York. Leslie T. Divine is Superintendent of Water Works. The Village Council of Monticello included Donald Block, Mayor, and Abe Rosenberg, Joseph Block, Harold Reynolds and Donald Pelton, Trustees. Thomas Belmont is Village Manager.

● **LOW temperatures in the winter necessitated the provision of an ice hood for protecting the center mechanism.**

● **WINTER in the Catskills is severe at times. Often ice forms on the clarifier surface, but overflow weirs are clean.**

Population Projections For LOCAL AREAS

MEYER ZITTER, U. S. Bureau of the Census

TO DATE, no exact methods or formulas have been developed which can predict future changes in population with any high degree of accuracy. At the national level, future changes in population are dependent primarily on the number of babies that will be born, and statisticians have had much difficulty in plotting the future course of the birth rate, even in the short-run. Special problems arise in the case of population forecasts for States and cities. Migration, in particular, adds considerably to the uncertainty of estimating future population trends and makes predicting future population a highly speculative endeavor. Nevertheless, the needs and requests for population projections are increasing. As a result, over the years a variety of techniques and methods have been developed. Some of the procedures attempt to analyze separately the factors that influence population change and to evaluate and assess their probable effect on future population in an area. Others are more mechanical operationally, and, in many instances, can be described by mathematical formulas or curves.

This article will attempt to describe some of the methods now in use. It is not intended here to exhaust all the various possible procedures one can use, but rather to discuss in some detail those which seem to be growing in prominence. The methods described were not necessarily designed to "predict" future population, but primarily to provide illustrations of the population that would result under various types of assumptions concerning future trends.

A somewhat more detailed study of methods of making population projections was published by the United States Department of Commerce, *Better Population Forecasts for Areas and Communities*, prepared by Van Beuren Stanbery, Washington, D. C., September 1952. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for 25 cents.

A general report which may be of interest to readers of this article is: Jacob S. Siegel, "Some Aspects of the Methodology of Population Forecasting for Geographic Subdivisions of Countries," Proceedings of the World Population Conference, Rome, Italy, August 31-September 10, 1954. A copy is available upon request to the Bureau of the Census.

The techniques currently in use fall generally into about three categories; "mathematical" (including graphic) methods which make use solely of past trends in *total* population of the area; demographic techniques analyzing separately the trends in the *components* of population change (births, deaths, and migration); and a variety of miscellaneous techniques using symptomatic data to estimate future total population without intermediate estimation of components.

Mathematical Methods

Under the general category of mathematical methods lies a variety of approaches ranging from linear extrapolation of past trends to the more complex logistic curve. The main advantage of mathematical or graphic methods is their relative simplicity. They also generally require considerably fewer data than other techniques. A recent study of methods of projecting *urban* population growth, for example, described a system of equations developed primarily for use in areas where only limited demographic information is available.[1]

There is some rationale to mathematical methods for use over short periods of time since a high correlation exists between population changes in successive periods. Also, since the logistic conforms more closely than other curves to a pattern of change characteristic of many populations over the long run and avoids the assumptions of continuous increases or negative populations, it is more appropriate than others as a long-range forecasting method. One weakness of mathematical methods is that they hardly can allow for anticipated deviations from past trends and are usually best suited for forecasting total population only.

With the development of more and more reliable statistical reporting programs, there appears to have been an appreciable decline in the use of purely mathematical methods and a more general acceptance of methods using symptomatic information. An analysis made in 1952 of about 90 reports presenting population forecasts for geographic areas showed that only about seven of the reports contained projections based on mathematical or graphic extrapolations.[2] Of more than forty recent studies examined by the writer (some of which are listed in the Appendix), only one or two mentioned such mathematical procedures. Consequently, it would be safe to assume that such procedures are now only of secondary importance.

The Component Method

The methods that seem to be growing in favor are those included in the second category. These include procedures allowing separately for the various components of population change, viz., births, deaths, and net migration. These

"component" procedures, as they are usually designated, are more logical in conception than mathematical methods and enable the forecaster to confine the area of speculation to the appropriate components. Evaluations of the reliability or validity of the projections can be measured in terms of the accuracy of the projected components. Furthermore, the system is sufficiently flexible to enable the forecaster readily to incorporate anticipated local developments that may affect the future trends in the components.

In the use of the component approach, we can distinguish between those procedures which involve projections of *total* births, deaths, and net migration from those which work with component data, by age. This second, more detailed application is generally referred to as the "cohort-survival" method. One theoretical advantage of the latter over the simpler approach is that it takes into account the effect of the current age composition on future population. The main practical benefit is that the procedure yields projections by age.

In using the component method, it is necessary to have appropriate information on vital statistics and net migration. These figures should be available for a number of past years, preferably for one or two decades, to provide an appropriate base for projection purposes. Projecting natural increase (the excess of births over deaths) presents some difficulties, but relatively simple techniques may be adequate. One simple technique involves the use of birth and death rates. Time series data on births and deaths are usually available locally, from the city, county, or State health departments. Although intercensal population estimates are generally lacking for most local areas, birth and death rates can be computed for census years, as 1930, 1940, and 1950.

> It would be desirable to average in with the births (or deaths) for census years, the numbers for the preceding and succeeding years in order to eliminate short-term fluctuations.

Birth and death rates for future years can be developed on the basis of the past relationship between the area rates and those for the United States as a whole. One could assume, for example, that the recent ratio of local rates to the national rates will remain constant throughout the projection period. Aside from year-to-year fluctuations, these ratios

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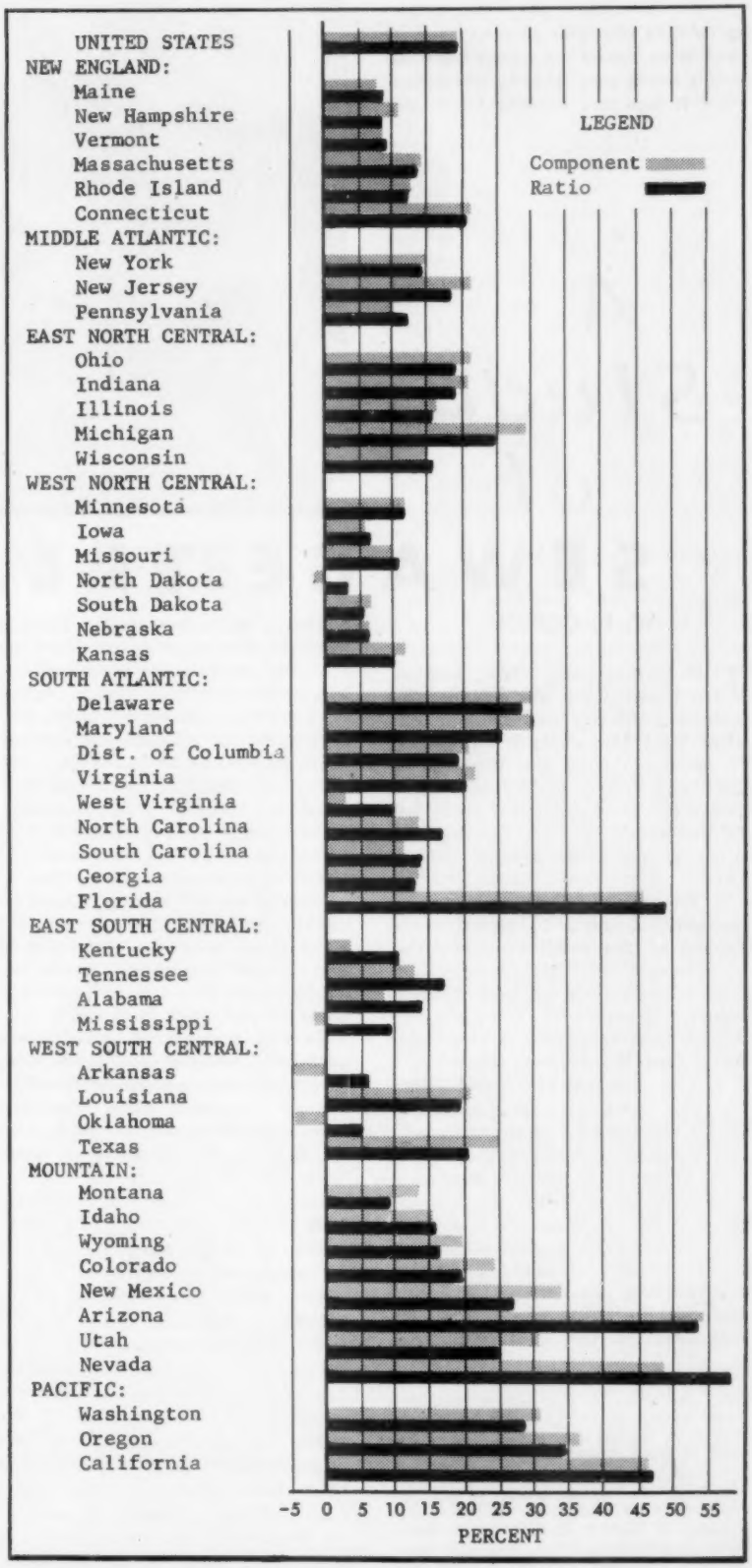
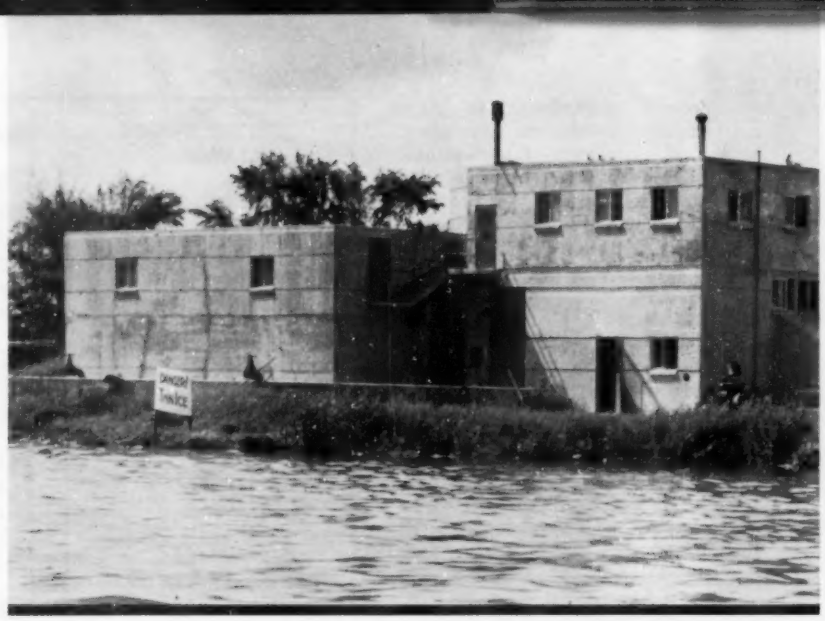


● **DIFFERENT methods give different results. This compares the ratio and component methods in projecting population changes for states from 1953 to 1965. Source is the U.S. Bureau of the Census Current Population Reports, Series P-25, No. 110.**



● WASTE treatment plant at Cumberland, Wisc., where the studies described in this article were made by Mr. Ogden. Plant is high rate trickling filter type.

A Study of SEWAGE TREATMENT

W. L. OGDEN*

THE Cumberland, Wisc., sewage treatment plant was designed by Robert J. Ellison and R. L. Smith of St. Paul, Minnesota. It was placed in service during the summer of 1954 and tested in October, 1955. There are several factors which led to the study of the Cumberland plant, among which are the following:

1. The waste being treated is a combined domestic-industrial waste typical of the small municipalities in Wisconsin and Minnesota.

2. A short term primary Spiraflo clarifier is used.

3. A high-rate filter is in service using Red Wing tile-media.

4. The intermediate and final Spiraflo clarifiers were operating under varying loads with some similar mechanical design features.

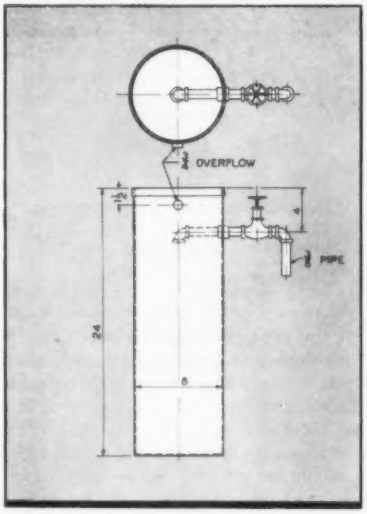
A study of factors numbered 2 and 3 should be of definite interest to consulting engineers, as the operating results of short-term primary Spiraflo clarifiers and tile-media filters are desired for design purposes. Lakeside was particularly interested in two similar Spiraflo clarifiers operating under varying loads in the same plant. The fact that the waste was typical of the Minnesota-Wisconsin region, makes the results of interest to Health Departments, city officials and consultants, as well as to Lakeside.

The investigation was made over a one-week period in October, 1955. Considerable time was devoted to evaluation of the operation of the clarifying equipment in use. Specific analytical results were obtained on the various major units of the treatment plant, with the exception of the sludge digestion system, on which observations were made but no analytical work performed.

Flow data, sampling, and all work performed was in accordance with recognized standard procedures. The sewage treatment plant operation was not changed in any way throughout the duration of these tests.

Cumberland has an estimated 1900 to 2000 population. The sewer system is of the separate type and 95 percent of the population is connected. Industries connected to the sewers include the Stella Cheese Plant and Minnesota Mining & Manufacturing Company. Rutabagas are processed in a plant with the waste water discharged into the sewer system, but the crop had been processed prior to the time of these tests. Essentially, the waste from this type of rutabaga processing consists of dirt, wash water and some small pieces of the vegetable. A cannery located in Cumberland has a separate waste disposal treating system.

The treatment plant consists of a mechanical bar screen with a macerator; grit chamber with mechanical cleaning equipment; Parshall flume with meter and totalizer; wet well; three raw sewage pumps rated 100, 225 and 325 gpm respectively; a 15-ft. diameter by 13′-2″ skirt depth hoppered-bottom primary Spiraflo clarifier without mechanical sludge removal; a 43-ft. diameter tile-media Aero-filter 6 ft. deep; a 26-ft. diameter by 9′-4″ skirt depth mechanized intermediate Spiraflo clarifier; two recirculation pumps each rated 240 gpm; a second stage filter approximately 40 ft. square by 8 ft. deep; and a 23-ft. diameter final mechanized Spiraflo clarifier. The actual detention in a Spiraflo clarifier is directly related



● QUIESCENT tank used for tests.

*At the time of the above test and prior to his untimely death in March, 1956, Mr. Ogden was a member of the staff of the Lakeside Engineering Corporation. Mr. Ogden received his Bachelor of Science Degree from the University of Illinois in 1943 and his Degree of Master of Science in Sanitary Engineering from Harvard University in 1947. Before joining the Lakeside Engineering Corporation, Mr. Ogden was with the U. S. Public Health Service with headquarters in Cleveland, Ohio.

EFFICIENCIES

to the distance which the skirt bottom extends below the surface.

Sludge and scum are collected at all clarifiers and pumped to a 35-ft. floating cover equipped digester. An external heat exchanger and recirculation pump are available for maintaining the digester heat. The digester is provided with the usual gas protective and utilization devices; also a supernatant selector. Sludge beds are available for drying of the sludge.

Collecting Samples

The flow diagram of the Cumberland, Wisconsin, plant is shown in the accompanying illustration. Sampling points used for this study were as follows: (1) Parshall flume; (2) primary Spiraflo clarifier effluent box; (3) first stage filter influent (recirculated and primary settled sewage mixed); (4) intermediate Spiraflo clarifier influent box; (5) intermediate Spiraflo clarifier effluent box; (6) final Spiraflo clarifier influent box; and (7) final Spiraflo clarifier effluent box.

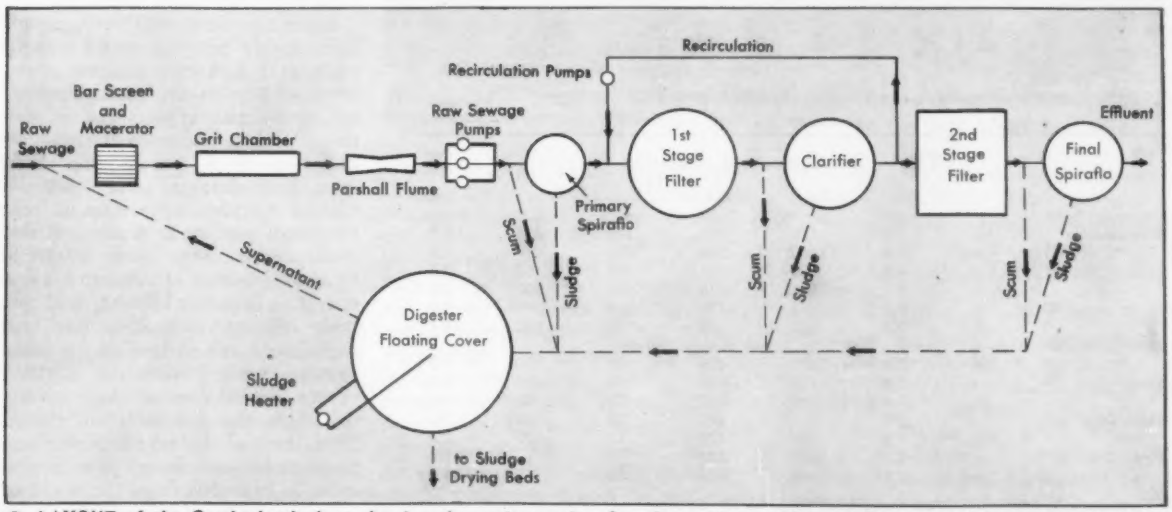
Samples were collected at half-hour intervals from each of the sampling stations. The sampling period extended from 7:00 am to 7:00 pm, a 12-hour period. The starting time of 7 am was selected after a study of plant records indicated that the "morning" flow was not received prior to that time. During the 12-hour interval of sampling, approximately 67 percent of the daily flow passed through the plant. The units on which this investigation was primarily centered, would undoubtedly have shown considerably improved results if 24-hour sampling were practiced, but as the purpose of the investigation was to determine what the operating results were under the heaviest loading conditions, the 12-hour sampling period was selected.

All samples collected were composited according to flow. Storage of samples was such that appreciable changes were prevented. Brown glass collection jugs were used, samples were cooled and kept out of direct light. Great care was taken to insure that the sample portions were truly representative. Individual dippers for each sampling location were used, and each dipper was rinsed out after a sample was taken and allowed to air dry in a drained position prior to collection of the next sample.

The person collecting the samples was an engineering student or engineering trainee. This individual was instructed in the theory of sampling and method of taking samples prior to the actual work. At no time during the 12-hour sampling periods was there a delay in collecting the sample or a questionable sample.

The composited samples were taken to a nearby laboratory and within a few minutes after sampling ended, the analyses were started.

Flow measurements were made by the indicator-totalizer-recorder in use at the Parshall flume. This unit was checked to see that the totalizer and rate of flow indicator were correct, and the charts were being installed properly. All graphs, illustrations, etc., which include the element of time in this report are actual times.



● LAYOUT of the Cumberland plant showing the various units. Sampling points used in study are listed in paragraph above.

An 18-in. rectangular sharp edged weir was inserted in the effluent channel of the first stage filter and individual direct readings were made at the time of sampling. A flow rate table computed by C. H. Barber, Engineer, and published by the A.P.H.A. was provided by the District Engineer of the Wisconsin Health Department for use in determining flow rates. It is considered that any error in individual flow rate measurements did not exceed approximately 3 percent.

Grab samples were used only on those portions of this investigation where their use would be of value. Grab samples, where used, are indicated as such.

Analytical Determinations

All analyses were conducted in accordance with the 9th edition of Standard Methods, with the exception of the dilution water used for BOD determinations. Due to transportation difficulties, it was impossible to "make up" and transport Formula "G" water; consequently, distilled water aerated to the saturation point was used throughout the investigation. This water was periodically analyzed to insure maximum saturation.

The well equipped laboratory of the Rice Lake, Wisc., sewage plant was used as the main laboratory for this work. Balances, incubator, refrigerator, etc., were calibrated and checked prior to using. Fresh reagents, properly prepared were used during the investigation. Care was exercised in the cleaning of all glassware, crucibles, etc., used at the laboratory. The dilution technic used in the BOD determination was that of the direct addition by pipetting into partially filled bottles. In most instances, two dilutions of each sample and two blanks were used.

Hydrogen-ion concentrations were determined by a colorimetric pH kit. No difficulties were experienced by this procedure, but the error inherent in any colorimetric device possibly was present. All pH readings were made by one individual with checks made by others, in an effort to reduce error and to make all determinations relative to the investigation.

Temperature determinations were made by a Centigrade thermometer and where temperatures of the sewage in the plant units are reported, these readings were obtained by immersing the thermometer approximately 24 inches below the sewage level. Air temperatures were checked against U. S. Weather Bureau reports for the area.

Flow rate data covering both raw waste and recirculation for two days are summarized in Table 1. During the two days of the tests, the raw sewage flow averaged 103,680 gallons per day, and the recirculation averaged 290,880 gallons per day. Table 2 presents the results of laboratory analyses on the 12-hour composite samples taken during the two days. All results, except pH, are expressed in ppm. Table 3 shows efficiencies of the various plant units. Sewage temperature was 18°C on both days. Industrial waste was received from the Stella Cheese Co., which handles about 60,000 lbs. of milk per day.

Table 1—Flow Rate Data

	Average 12-hour Flow	Max. Flow	Min. Flow
RAW WASTE, gpm			
10/27/55	143	210*	70
10/28/55	145	200	80
Average	144	205	75
RECIRCULATION, gpm			
10/27/55	402	500**	150
10/28/55	406	469	273
Average	404	507	161

* from recording chart
** manual operation of pump

Table 2—Operating Results

Sampling Point		pH	Total Solids	Dissolved Solids	Susp. Solids	BOD	Settleable Solids
Raw Sewage	—a	7.0	976	758	218	436	2.5
	—b	7.4	1060	854	206	465	2.4
Primary Effl.	—a	6.8	780	582	198	351	0.4
	—b	7.0	816	616	200	330	0.1
to 1st stage Filter	—a	7.0	692	558	134	260	0.8
	—b	7.2	652	516	136	200	0.1
Inter. Clar. Infl.	—a			no samples collected			
	—b	7.4	552	450	102	110	1.0
Inter. Clar. Effl.	—a	7.2	472	432	40	115	0.06
	—b	7.4	508	435	73	90	trace
Final Clar. Infl.	—a	7.0	532	480	52	30	1.0
	—b	7.2	520	478	42	20	0.3
Final Clar. Effl.	—a	7.2	540	522	18	9	0.0
	—b	7.2	552	524	28	5	0.0

a—samples taken 10/27/55; b—samples taken 10/28/55

Comparative Analysis

In the study of the operation of this plant, as in others, it was readily apparent that to compare the operation of any given unit, combination of units, or the plant process, with other plants, units, or combinations, would be misleading. The plant units and plant were performing satisfactorily according to standard engineering criteria.

The important consideration in evaluation of this or any plant must be, however, in respect to how well any given unit is performing in reference to the waste it is handling. It is certainly not good engineering practice to say that because a treatment plant unit is removing X percent of BOD at Cumberland, it will remove X percent at Blanktown.

Table 3—Efficiency of Plant Units

Plant Unit		Percent Reduction of Susp. Solids	Percent Reduction of BOD
Primary Spiraflo			
	—a	9.2	19.5
	—b	3.0	29.0
1st Stage Filter & Inter. Spiraflo			
	—a	70.0	55.7
	—b	46.4	55.0
2nd Stage Filter & Final Spiraflo			
	—a	55.0	92.0
	—b	48.0	94.5
Complete Plant			
	—a	91.9	98.0
	—b	86.5	98.9

a—samples taken 10/27/55;
b—samples taken 10/28/55

To determine whether the clarifiers were performing adequately at Cumberland, comparative tests were made between the clarifiers operating continuously or normally, versus a perfectly quiescent condition.

The procedure followed in this comparative test was to fill a small metal test tank to a predetermined level with influent; then, knowing the flow rate, at the end of the theoretical detention in the clarifier under study, a sample was taken from the clarifier effluent simultaneously with a sample taken from the small test tank. Analytical determinations were then available from the samples of influent sewage, operating clarifier effluent, and test tank effluent. Basically, this was therefore a comparison of the same sewage under quiescent settling versus continuous settling. In the test tank, the sample is withdrawn from the tank below the water line to exclude any scum, just as the scum is excluded from the weirs of

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ELECTRONIC COMPUTATION OF PHOTOGRAMMETRIC DATA . . .

GEORGE MACDONALD,
Lockwood, Kessler & Bartlett, Inc.

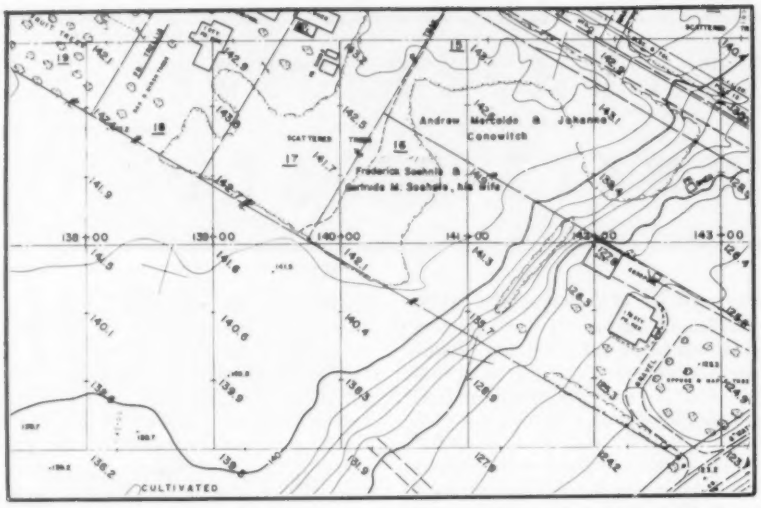
HIGHWAY engineers over the past ten years have become accustomed to photogrammetric maps $1'' = 200'$ with 5′ contours for studies and preliminary estimates. During this period as thruways, expressways and freeways have become known and popular, there has come also the gradual recognition that these designs require consideration of a broad band of topography rather than the more customary line and profile concept. Today we find that the desired standards for Interstate highways call for roadways completely separated in line and grade and with malls of 100, 200 and 1,000-ft. widths. Obviously, for effective design some medium must be used which will give the designer a picture of the whole band of interest, so that he can see the relation between the two main roadways, the frontage roads, the intersecting roads and streets, streams, railroads and utilities, land use and occupancy; in short, so complete that he can see all possible solutions in his search for the best alinement. But a picture is not enough, it must have reliable accuracy both horizontally and vertically.

The answer is a topo map, with an average width of about 1,200-feet, widening at intersections and interchanges and comprising about 125 acres per mile of highway. In these days of tight schedules and shortages of engineering personnel, precise photogrammetric maps are being used instead of field surveys. Their speed, detail and uniform accuracy have been proven for their intended purpose. Once an organization has invested in a 2-foot contour photo map, the photos may be made to yield elevations to a still higher degree of accuracy than the contours. This is because a stereo operator is able to read elevations of single spots to an accuracy of 1/5,000 of the flight altitude, whereas to follow the meanders of a contour line he can be certain to only about 1/1,000 of the flight altitude. In fact, the so-called first order instruments are rated at 1/12,000 of the flight altitude. If, then, we are plotting 2-foot contours we will have photographed from an altitude of 2,000-feet and have a potential vertical accuracy of 0.4 of a foot to 0.2 of a foot.

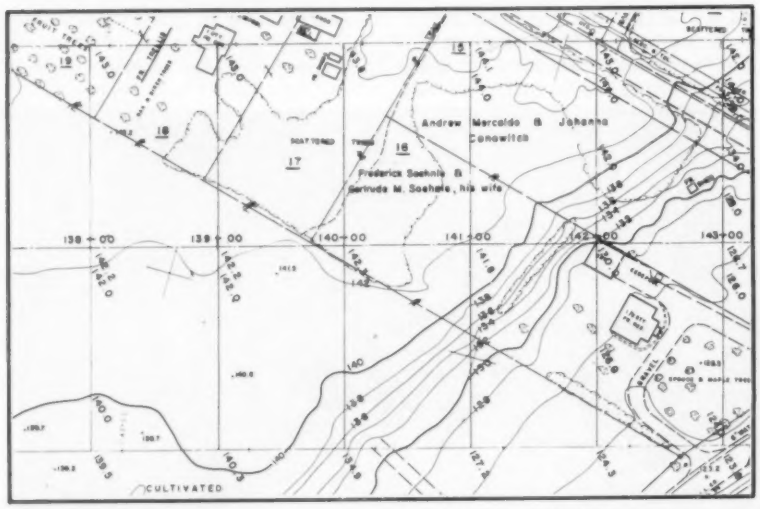
Why not substitute photogrammetric readings for field cross sections? This thought has occupied some of our time for the past year and we now feel we have some answers which may prove of interest. Our tests have been centered on using the Wild A-5. This is a first order instrument. Let us assume that we have a map, and, that the designers have laid out the roadway centerline and drawn the lines to be cross sectioned. Let us return this map to the A-5 drafting table and put the aerial photos back in their proper orientation in the A-5. When the operator puts his reference mark in the optical system over a point, the pencil on the plotting table moves over the same point on the map, as it is linked to the floating dot by a train of gears. The assistant on the drawing board guides the pencil over the beginning of a cross section line, the operator adjusts the floating dot just to touch the ground, reads and calls off the elevation, and the assistant writes it opposite the point marked by the pencil. Cooperatively they move the pencil to the next break in grade, repeat the process, and continue to the end of the section. For a 600-foot section, an average plotting time is about 20 minutes. No bush cutting is involved, and the floating dot can move up or down changes in grade effortlessly, changes that might require several instrument set-ups to traverse; and the stereo operator takes many more "shots" than his friend the rodman.

● **A-5 STEREO plotting instrument and its connected plotting table. Operators Plunkett and Searles are recording spot elevations on the Long Island Expressway.**

Now having used this alinement of airplanes, cameras, lens, prisms, and gears to eliminate tedious field cross sectioning, it would hardly be consistent to take these cross sections, plot them by hand, planimeter the areas, and then compute the earthwork volumes. Electronic computing machines can be instructed to compute the area of any given cross section. We believe, however, that their use should not be limited to mere arithmetical answers to a completely stated problem, but that they



● **THIS MAP was prepared from cross-section elevations taken by a field party.**



● **THIS was prepared from contour map. Some elevations differ from map above.**

● **COMPARED with the maps above for the same area, note the greater number of elevations provided by the A-5 stereo. Generally, they also proved more accurate.**

should actually be used to take over some of the design of the cross section. In cooperation with Illinois Bendix, we have worked out a plan for what we are going to call a general program for Interstate highways. This program will allow us with a G-15 to leave to the judgment of the computer, within instructed limits, such matters as side slopes in cuts or fills, ditch depths, and location of slope stakes. It will print all this out, plus the earthwork volumes; but there is no need to stop there, and this is the real economy of the computer. If the earthwork between control points is not balanced on the first try, the designer does not have to go back through the long process of shifting the line or grade and recomputing by hand the new volume. He has merely to instruct the computer to move it in or out, up or down, and eliminate everything except the final volumes. In a very few seconds he has his new answer.

Now it is logical to ask, if the A-5 or similar instrument can replace field cross-sections for design, why can we not also eliminate field cross sections for pay quantities? This is no matter to be taken lightly, as the earthwork involved in this forthcoming highway program will amount to between 10 and 25 percent of the construction cost. Everyone recognizes at the start that there is no absolutely accurate method of computing earthwork quantities. Over the years we have come to use the so-called average end area method as a compromise accepted by both parties. We believe that for ready acceptance the next step should continue with the familiar average end area method and hence if we take cross sections by the stereo plotting machines and compute them similarly to field cross sections, we are merely changing rodmen without upsetting the familiar computing process.

A photogrammetric map is a series of photographs taken from an airplane which may be undulating in flight. These photographs are corrected by a network of precise horizontal and vertical survey points, marked on each photograph, which serve to orient the photos in the stereo plotting machines. By means of procedures based upon the geometry of the camera lens and the plotting instruments, correlated with the ground control, the photos are oriented in the instruments so as to permit the operator, viewing stereoscopically, to plot a map correct in plan and elevation. This is a mathe-

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BEFORE . . .

. . . AFTER

BETTER LIGHTING *for* A WIDE MAIN STREET

H. E. PICKLE,
Director of Public Service,
Hollywood, Florida

HAVING a wide main street may be an asset where traffic flow is concerned but when it comes to street lighting the wide street becomes a problem. It was just that in the City of Hollywood, Florida, where the main street is considered one of the widest thoroughfares in the world. Increasing the need for improved lighting was the fact that the street ran through the heart of the downtown business area and on it most of our automobile mishaps took place. Another factor that had to be considered was the possibility of winds of hurricane intensity which would require standards, mountings and fixtures of suitable design.

The street lighting system in 1949 consisted of various types of units installed at random and in no recognizable pattern. Lights were placed at all heights, various angles and on short and long arm brackets. Damaged or broken glass was ignored and not replaced. The illumination in the downtown business district consisted of ornamental posts with enclosing globes that directed the light skyward. In 1949, Hollywood was spending $17,000 per year for lighting units but no light.

Since there was no city with a corresponding problem that had ever solved the problem before, the City could go nowhere for data and information. It was therefore decided that a series of experiments would have to be conducted to find the most practical, economical and pleasantly esthetic lighting system possible. A city-wide survey was made and every intersection was checked to determine the lighting requirements. A master plan was prepared, based on a traffic study compiled in co-operation with the Police Department. It was determined that a concentrated effort was to be made to light properly each intersection and the downtown business area first. Later mid-block lighting would be installed as money was made available. Six types of standards were installed and tested. Over fifteen types of luminaires were used and checked for light distribution and intensity.

In 1950, all through streets were provided with 4,000-lumen enclosed units; 2500-lumen Suburban Units were installed in lightly travelled residential areas; 6000-lumen lights were installed on all medium traffic streets.

A separate study was made of the business area and test installations were made of the various types of lighting units available. Fluorescent lighting was considered, but in view of the size of the luminaire and the fact that hurricane force winds had been experienced in past years, it was felt that such a unit was subject to storm damage.

The final decision resulted in the installation of 169 20,000-lumen mercury vapor luminaires on 30-ft. steel poles. This work was completed in 1954 and was the first installation of its kind in South Florida. In recent years, all major lighting installations have been of the same type. The city, in 1949, had 1,044 lighting units with a total of 1,746,000 lumens out-put. In 1957, there were 1,368 units rated at 7,372,000 lumens. Hollywood now spends $60,000 per year for street lighting. The development of new areas and the subsequent need for intersectional lighting has prevented the City from entering the third phase of its program; namely, mid-block lighting.

Currently 22 units are being installed along the balance of the main street's expanding business area and approximately 50 are to be installed along A1A when that new highway is completed. Cost breakdown shows that each unit in 1957 averages $525 for initial installation. The power costs per unit per month is $4.60 for the 20,000-lumen lamps on City-owned poles and $2.10 per month for the 2500-lumen lamps on Company-owned poles. Standards are Kerrigan, Model No. 100K-8B-316 with cast steel bases. Luminaires are General Electric, Form 400, Model 2F400A13.

The night accident rate in the area using the new type lighting is down despite the tremendous increase of traffic, due to our population growth. Compliments received by the city and by local merchants from many visitors make it apparent that well lighted streets are a great asset to a community.

Highway Planning for The SMALL CITY—

THE TRAFFIC STORY

WHERE ARE THEY GOING?

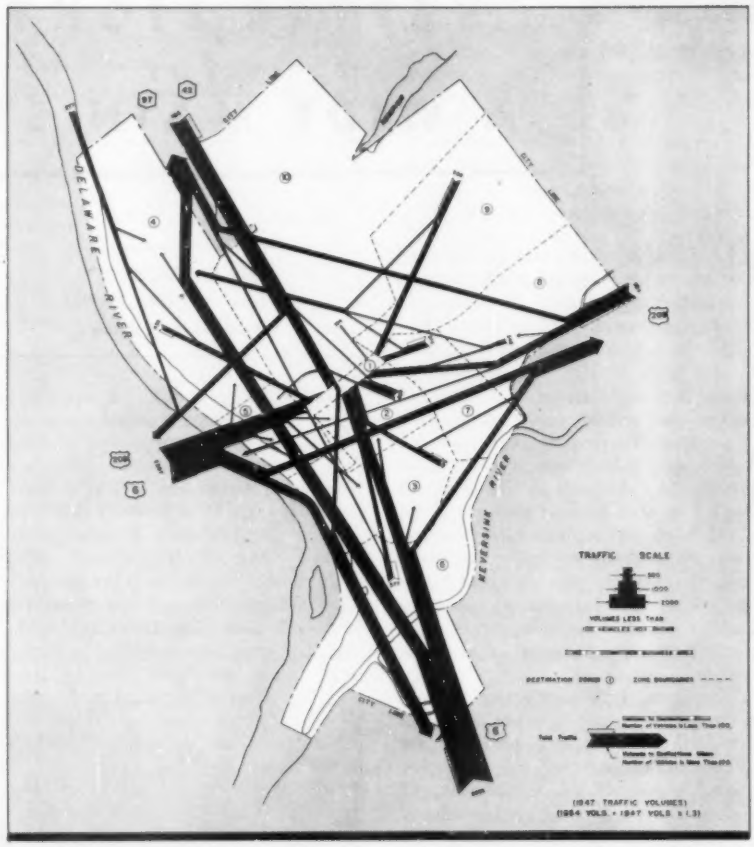
JACOB MENDE

AMERICANS have the knack of doing things bigger and better than any other people on earth. This is true of traffic jams, too. When the engineer who has the responsibility for his city street network looks at the seemingly endless streams of vehicles, he must feel tempted to say, "Don't they have a home?" One way to find out is to ask.

Counting cars, no matter how comprehensively, is only one side of the traffic story. The other side, "where are they going," is an equally indispensable phase of a complete traffic study. This information is best obtained from an origin and destination (O & D) survey, which can be designed to suit the needs of any size community. The engineer will usually have to show the need for an expenditure of time and money on this type of project. It is best to explain in terms of dollar savings.

The most telling argument for an O&D survey is that knowing instead of guessing at people's travel habits yields the maximum traffic service per dollar expended on construction. Like the x-ray, the origin and destination survey exposes concealed elements to view. A traffic stream, like the blood stream, may contain impurities which cause congestion, such as through traffic, or longer internal movements, both of which could to advantage be bypassed around the busy downtown area.

It could well turn out to be a misplaced or needless expenditure of public funds to improve an existing traffic artery simply because it is overloaded. Often a significant volume of traffic uses a particular route simply because there is no more direct route available. Based on an origin and destination survey, such a new direct facility could be provided to meet this need, thereby solving the traffic problem on the original route.



● **RESULTS of an origin-destination survey and study are plotted for a smaller New York State City. Methods of making the study are described in the text herewith.**

Traffic engineers have devised various types of origin and destination surveys to get the answers to, "Where are they going?" Which one is adopted for a particular study depends on the size and location of the area, the scope of the study, the time and money available, and of course the element of personal preference. The most commonly used O&D surveys in best practice today are the home-interview, roadside interview, and questionnaire postal card. Sticker-type surveys do not prove too satisfactory.

The home-interview method of getting O&D information is not only beyond the limits of the usual small-town budget, but also beyond the degree of effort that should be expended on a small area. This type of survey is recommended for large metropolitan areas with tremendous traffic volumes and complex road networks. The procedure

is similar to taking a census. Elaborate preparation and training of personnel is required, and in addition to the home interviews, roadside interviews are required at an outer cordon to complete the project.

The small-town engineer, who is concerned with lesser traffic volumes and a smaller area, will therefore choose between the roadside interview and the questionnaire postal card method for making an O&D survey in his city. Although the postal card survey at first glance looks simpler and cheaper to operate, this method sometimes yields very misleading results.

The First Step

Whichever type of survey is to be made, the first step will be to prepare the base maps and set up the survey stations. The engineer will have to decide how detailed a study is required before breaking up the city into zones, which should be so planned that the O&D data are significant. For example, the central business district for retail shopping should be distinguished from the warehouse and oil storage section. Likewise, the industrial area should be set up as a separate zone. If possible, the size of the zone should be inversely proportional to the traffic volume, since a small compact zone with much activity will generate as much traffic as a large area of scattered one-family homes.

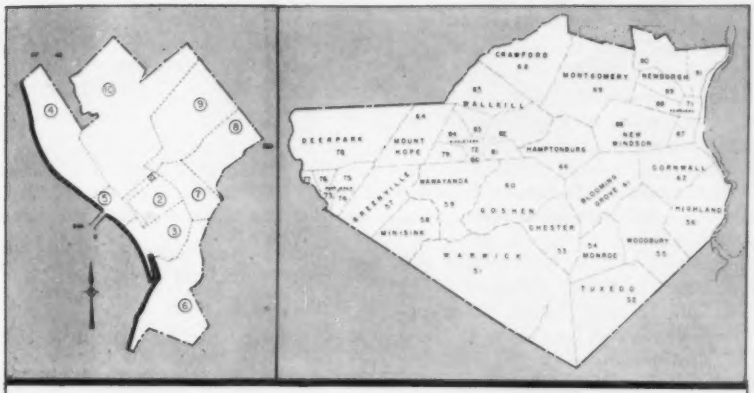
It is better to have too many zones than too few, as smaller zones can always be grouped for analysis if so desired. Important outlying areas should also be given individual zone numbers rather than grouping them with the rest of the county, as these neighboring suburbs usually exert a strong influence on the community traffic pattern.

A survey station should be established at every main highway entering the city and carrying volumes of at least 500 vehicles per day. Traffic arteries carrying less than 500 are usually not important enough to warrant setting up a station. Depending on the volumes, from 20 to 100 percent of the entering traffic will be stopped at the survey stations. Adequate prewarning and warning signs should be provided, and a police officer should be on hand to assist in traffic control. Survey station locations should be carefully selected to permit safe passing by vehicles which are not to be stopped and also to provide ample clearance for outgoing vehicles.

The O&D survey should be planned for a Tuesday or a Thursday in August during the 6 AM-6 PM or 7 AM-7 PM daylight hours, depending on which period includes the heavy morning and evening peaks. The O&D survey preferably should be made after a comprehensive volume census, or traffic count, has been completed and the data are available as a guide to personnel requirements, percent of sample, etc.

If the questionnaire postal card method is used, the postal cards should be numbered consecutively and a record kept of the serial numbers handed out during each hour. The postal card can be designed to suit local needs, containing as few as two questions, "Where did this trip start" and "Where will it end", or as many more as desired, such as Purpose of Trip, Parking, Routes Followed, Frequency of Trip, Type of Vehicles, etc. If traffic is too heavy to stop all vehicles during peak hours, even to distribute postal cards, as large a sample as possible should be taken.

The roadside interview survey differs from the postal card survey only in that the motorist is directly asked the desired questions and the answers are directly recorded on interview sheets. This type of sur-



Traffic Survey August 1947

ZONE OF ORIGIN		DESTINATIONS: CITY 1	2	3	4	5	6	7	8	9	10	SUB TOTALS	ORANGE COUNTY 60	71	72	75	77	78	SUB TOTALS	OTHERS H	J	K1	K2	M	N	O	P	X	NORTH	EAST	SOUTH	WEST	SUB TOTALS	GRAND TOTAL
CITY	1																									7	9			5		21	21
	2	302		11	49	62	7		7	11	10	465	14			15	20	3	53			21		7				55			6		89	607
	3	244	10		30	13			13	10	17	368			7	20		13	40			10	7					23			10		69	475
	4	101	40	10		47	25	23	10	10	10	360	10		5	5			20			5	5					30			5	5	50	430
	5	41										41			5			5	10	5												6	57
	6	208	19	19	82	21		24		44		396	10			6	19		35	5		10						79			20	8	140	577
	7	325	23	7	89	29	6			7	14	500	5				14	7	26			7						27			14		48	574
	8	130	7	4	52	14				7	7	221					8		8			7						12					19	240
	9	290	30	17	36	48	6	16			4	457	5		12		8		25									35			17		40	526
	10	56	5		7	5	10		5			84	5			10			15			5											5	104
SUB TOTALS		1745	133	71	344	239	56	85	35	100	62	3890	53		29	87	68	28	236	11		83	12	7		7		275			90	10	493	389
ORANGE COUNTY	60	238	24	14	83	40	11	10	9	87	17	436										38						110	5		37	31	215	651
	71	23			5							28					4		4									14			5		19	51
	72	84	12	4		11	5		6			122					9		9			13						54			10	5	82	219
	75	179	8	33	19		8	8	25	16	4	298					4		4			17		4				44			28		93	395
	77	61	17	44	54	33	4	25	19	9	10	306	4		4				8			10		17				64	4	8			103	467
	78	174	15	4	7	14	4	4	4	4	4	234	4						4			4	4		4			33			15		52	293
SUB TOTALS		879	77	99	88	98	39	47	63	54	35	1477	8		4		17		29			82	4	17	8			395	9	8	101	36	370	2076
OTHERS	H	7									5	12																74			20		94	106
	J	8						4				12													30	4		4			36		74	86
	K1	275	13	15	24	23	15	6	21			392		4	35		6	9	49					8	77	9	4	72	9	86			251	704
	K2	4		4								8	5		4		4		13			6		4				31	4	36			99	120
	M	23	5				5	5				38	5			5			10		10	75	11					47	15	6	35		200	248
	N	5										5				5	5		10			87						13	10			5	55	70
	O				6							6																90				45	143	149
	P																								4			53			9	9	95	95
	X	760	86	84	63	115	16	42	20	27	11	1177	15	11	62			37	225	46		48	53	60	5	74	48		39	30	47	5	482	1804
	NORTH	13										13	9		4				13			6		4				75			41	5	134	166
	EAST	9				5		4		5		18					5		5			10	5					45			7	24	91	114
	SOUTH	230	15	20	40	19	10	21	13	14		421	10	5		5	5	20	45	37	49	55	32	16		5	80	27	88			30	331	798
	WEST	13	4			6				7		28				5			5	14	5			18	25	33	29	34	4	16	36	10	216	256
SUB TOTALS		1903	154	163	137	167	58	90	54	59	16	2796	144	30	111	18	34	71	365	84	89	314	117	217	91	112	126	543	153	77	430	172	2330	4788
GRAND TOTAL		3977	364	282	593	504	153	202	154	212	104	8308	205	30	144	77	110	95	660	95	89	373	133	241	99	119	126	1138	196	81	438	218	3290	10453

● **UPPER left is Port Jervis; Orange County is upper right. Below the maps is a tabulation of the results of an O-D survey, based on the numbers shown in the maps.**

vey requires a little more in the way of traffic control, as a simple two-question interview will take from 15 to 25 seconds compared to the 3 to 8 seconds required for postal card distribution. The positive results make the interview survey worth the extra effort, and additional questions can be asked as desired. There is no guesswork in expanding interviews to the full volume when sampling is necessary because of peak loads. Also, there is no delay in waiting for returns, and no concern about whether the returns truly represent the whole traffic stream. It is of course necessary to exercise care in sampling when 100 percent is impracticable.

Using the Data

Like the hunter with the bear by the tail, the question could be asked, "What do I do now?" The O&D data must be analyzed to be useful in planning the city or village street network. Since mechanical processing is very costly, a manual tabulation should be set up to show all trips, making a separate analysis for each survey station. This analysis will show every origin to every destination of traffic entering the city via the particular station. If the postal card method is used, the analysis will be similar, with the number of returns instead of the number of interviews expanded to the full total for each hour of the survey, and the expanded total used in the table of origins and destinations by stations. To obtain the hourly totals, a classification count should be made in the inbound direction during the O&D survey.

Once this primary tabulation is made for each survey station, the engineer easily can make additional analyses. From the table of Origin Through Station to Destination, a table of Station to Destination is readily made up by simply grouping all the origins. This table shows the dispersal of traffic entering the city on each important street, without regard to where the traffic originated. A third table that will be found useful is the zone to zone movements, simply a grouping of travel by zones of origin and zones of destination, without regard to what route the traffic used to enter the city.

Plotting the O&D data will be the last and most satisfying step in the survey project. Using an 18″ x 24″ base, and a scale of 3000 to 4000 vehicles per inch, for volumes up to 5000 in a 12-hour period, the travel desire bands can be drawn to show the destination of traffic entering the city through each survey station. A second plate will show travel on the basis of zones, rather than points of entry. These two plates will usually be sufficient for the study. Both O&D plates can nicely be reduced to a 9″ x 12″ page size as companion plates to the volume maps made up from the first phase of the comprehensive traffic survey.

The origin and destination survey is not a theoretical research project, but a practical planning tool. The O&D data, coupled with the traffic maps and the land use map series, will permit the small-town engineer to roll up his sleeves and start planning his highway system.

For Further Study:

Many helps are available to the small-town engineer when he is ready to set up his origin and destination survey. Any or all of the following have technical staffs and usually literature to assist him with his traffic study:

1—Highway Research Board
2101 Constitution Ave.
Washington 25, D. C.

2—Highway Transportation Research Branch
U. S. Bureau of Public Roads
General Services Building
F St. bet. 18th and 19th
Washington 25, D. C.

3—Eno Foundation for Highway Traffic Control, Saugatuck, Connecticut

4—State Highway Department of his home state. (This source of help can not be relied on nationwide, however, as some states do not have the technical staffs)

SANITARY and STORM SEWERAGE *for an* AIRPORT TERMINAL

WALTER RUDOLPH

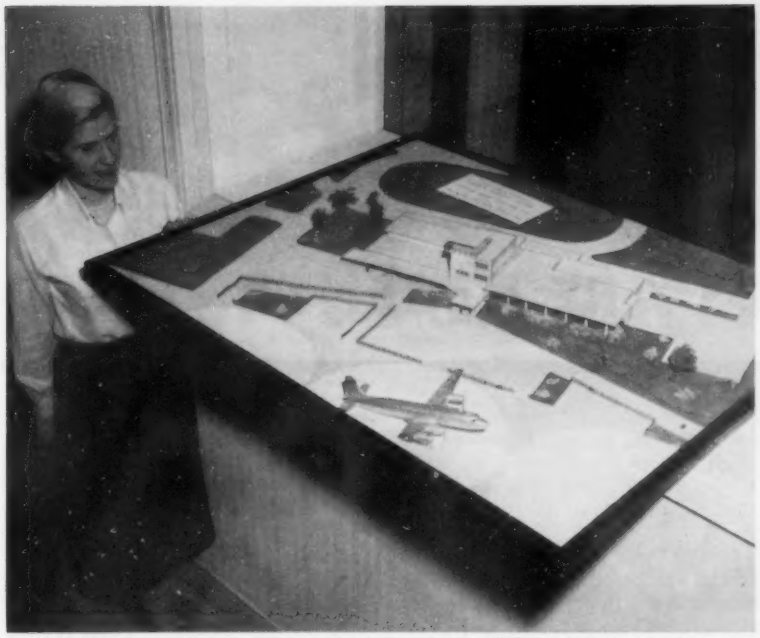
FLEXIBILITY in design is one of the important features of modern airport construction because of the expanding future foreseen for this "Air Age." This flexibility is exemplified by the new terminal building and control tower at Port Erie Airport, Erie, Pa. Nelson, Goldbert & Heidt, registered engineer and architects, designed the $600,000 structure and chose general materials for mechanical construction. Services needed to make the building function properly from the mechanical standpoint (". . . for years ahead,") were laid out by Donald Kennedy, Professional Engineer, Erie, Pa.

One of the most pertinent phases of construction is that for providing the terminal building with its own storm and sanitary disposal system designed to be adequate for a decade and more. The storm drains are tied into the miles of vitrified clay pipe for drainage already underlying airport grounds. The sanitary disposal system, on the other hand, required a self-sufficient installation for the present and the future, because the airport lies several miles beyond city sewer lines.

The fact that needs would be flexible was pointed out by the CAA traffic survey taken some time before plans were prepared for the airport improvement. Erie's Airport Authority also surveyed possibilities, before hiring the architectural firm to draw up plans. It was decided to provide a sewage disposal system large enough to serve from 750 to 1,000 persons daily.

This is well over the expected usage of the terminal building in the immediate future, but allows for some 40 percent possible expansion of facilities of the building. Following is a description of the disposal system:

A short distance from the terminal building a 5-in. sanitary line



● MODEL OF proposed Port Erie Airport Terminal and Control Tower. Problem was to design a sewage disposal system to serve up to 1,000 airline patrons per day.

● FRONT-end loader on crawler was used for handling the tile for the plant.

● THEN it helped to lay the lines, acting as carrier, digger and bulldozer.

enters a septic tank 24 ft. x 10 ft. x 7 ft. The tank is built of reinforced concrete, and the exit end of the structure includes a dosing tank 4 ft. x 10 ft. x 7 ft. From the dosing tank sewage passes through alternating siphons, through two 4-in. outlets, to two distribution boxes.

Each of the latter empty into ten 4-in. clay tile lines, fanning out into the drainage or leaching field. This field was constructed by excavating an area 114 ft. x 100 ft. to a depth of 6 ft. Ten inches of washed gravel were spread out in this excavation. On top of the gravel the 20 lines of open-joint drain tile were laid. These drain line joints are covered with strips of tar paper and about a foot of washed gravel placed over the drain lines. Then comes a cover of unwashed gravel; and finally top soil.

The system is designed so that the alternating siphons will take turns flushing into the distribution boxes, one at a time, utilizing the two sets of ten drain lines each in alternating order.

Modern equipment and methods were used to install the storm and sanitary systems with minimum working time and labor. Wm. T. Spaeder Co. of Erie had the plumbing contract, and Don Green subcontracted excavating and drainage field labor.

Green utilized a tractor-mounted, hydraulic backhoe with a reaching capacity of 11 ft. to dig storm drain trenches. These trenches were just wide enough to permit a man to lay slip-joint, vitrified clay pipe. The storm lines graduated in size through several hundred feet of installation, from 4 to 10 ins. in diameter; the 10-in. clay line ran about 100 ft. to an existing storm drain in the air field. The ease of trenching with the narrow backhoe, and the speed with which slip-joint pipe could be used, made possible record installation time.

A light, quick-handling crawler with a high-lift attachment was used to move and spread washed gravel brought in by trucks. Then the high-lift was used to move about 40 units of drain tile at once, from the high bank of the excavation to the proposed lines in the drainage field.

Finally the crawler was able to spread washed gravel over the drainage lines to a depth of about one foot, without displacing or breaking tile. All these factors were important in taking advantage of good weather for completing the job.

General contractor for the job was E. E. Austin & Son, Inc. Work was begun late in the summer of 1956 and was completed early in 1957. Total construction costs will be approximately $800,000, including taxiways, aprons and other facilities. The money will come 50 percent from the CAA; 25 percent from the Pennsylvania Aeronautics Commission; and the balance from the Airport Authority, through city and county government funds.

● TRACTOR-mounted hydraulic backhoe, capable of digging 11-ft. trench, was used for storm drain trenching. Trenches were just wide enough to permit pipe laying.

CITY SERVICES ARE DECENTRALIZED

GUY BROWNING ARTHUR

IT ISN'T easy for a large, rapidly growing city to change completely its service organization plan and build an entirely new physical establishment. That is a stupendous undertaking. Dallas did it, and it is called "the best project of the administration." H. H. Stirman, Director of Public Works, directed the execution of the project, and is proud of it, with good reason.

Dallas is "the New York City of the South," a great commercial and banking center, growing steadily. Today it has 435,000 people, 50 percent more than a few years ago, and it covers 200 square miles.

Not very long ago it covered only 45 square miles, and then all the automotive services and their equipment were comfortably housed in a central garage, right in the middle of town. It was easy to believe they would continue to operate from the old garage; much easier than to see that Dallas was about to grow out of its old clothes. There had been some modest expansion, but it was stopped by small towns on the fringes. Then these towns found it advantageous to combine for better services, and later they found it still better to come into the city. Then Dallas burst out in all directions.

To a few persons it was clear that continued operation from the old garage was impossible. Some bad conditions there grew worse, faster than the city grew bigger. Transportation of men working out from the garage was becoming more expensive, until there was a loss of two hours in an eight-hour day for hauling them to and from work.

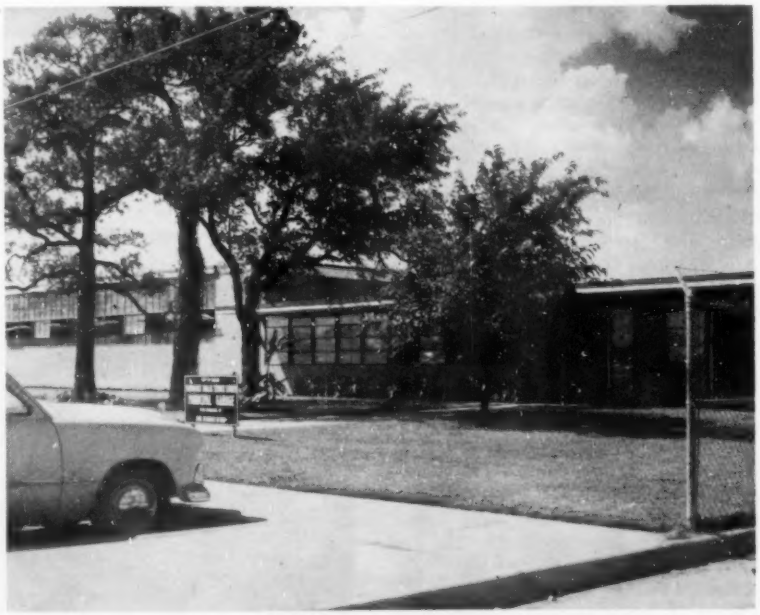
Employee relations were getting steadily worse. There were too many men reporting to one place. Too many were losing the old-time personal contact with their foremen. It was becoming too easy for agitators to stir up trouble. Too much concentration, too much system, too much remote control—and too little of the close relations between a boss and his men that hold employees steady.

One of those who saw this was W. Lowell Fisher, then employed in the automotive equipment organization of which he is now the head. He has been in the department 28 years. He stayed through changes of city manager, council, and public works directors. He worked with one after another through these changes, showing up the loss of efficiency and building up an idea for a complete reshuffle.

Some derided his plan and scoffed at it; here and there one looked at it twice and thought it might work; but all turned it down. The reason why it could not be accepted by politicians was that it would cost money which they wanted for projects they had promised to voters. The consolidation plan would make no showing for voters; it would add nothing directly for them. It was not a bridge, or street paving, or a school. It wouldn't light streets, or carry sewage. Why should they spend money to make it easier for city employees?

Through all the changes of personnel and shifts in policy Fisher doggedly but skillfully promoted the plan, with one administration after another, in good seasons and bad, in spite of rebuffs and rejections. But even those who withheld approval agreed that his idea was soundly conceived and comprehensive.

Today the plan is standing in fine modern service buildings in four outlying corners of the city; an accomplished project. Director Stirman gives full credit for the out-



● **FRONT of the office of the Automotive Equipment Section at Headquarters, the Southeast Center. The main shop is at the left in the upper part of the building.**

. . . BETTER OPERATIONS RESULT

come to Lowell Fisher, now Superintendent of Automotive Equipment, one of five superintendents in the Southeast Center, which is headquarters for all services.

The Plan

The plan is simple. Now in operation, it has proved one of the salient arguments used in promoting it. It facilitates work on all other projects, and makes it easier to handle them at lower costs. Only $2,000,000 was proposed and voted for all financing.

There are four service centers, located well out on the fringes of the present city area. Land was cheaper in those areas. There were more good sites to choose from, close to main highways and streets. Most of the new work will be in the outer sections, especially with new land being taken into the city.

Headquarters for all operations is in the Southeast Center, where there are four main buildings on 25 acres of land. It has cost $750,000. Here are main offices for:

Water Department (including Sewerage), (which is not under the Department of Public Works); Police Department; Automotive equipment, except fire apparatus; Street maintenance, except engineering jobs; Street cleaning; and Garbage and trash disposal.

Each of the other centers is a miniature of this headquarters plan. Each one cost about $350,000, and has about the same area, 25 acres. The ground at the Northeast Center cost $2250 per acre, which shows that land costs enough even out that far, and the price is rising rapidly.

All the buildings in the four locations are well planned, both architecturally and functionally, and present a very pleasing appearance. All are one-story, on paved areas which insure easy access to every building. There is a railway siding into each one. Filling stations, with accessory services, are placed in excellent spots away from other buildings, yet close enough to serve all equipment with no loss of time.

Each of the centers is articulated on the pattern of the headquarters, with buildings and work areas assigned for each department.

As a whole, and in detail, this is big planning. On 25 acres each of the centers can expand for years to come. It says, in perspective, that Dallas is destined to become much bigger than it is at present. Shortly it will be announced that the city area has become 240 square miles, up from 200, and there is no stopping point in sight. That can be explained—it is in Texas, where everything is bigger.

Administration

The gains for administration have been remarkable. All superintendents, except for water and sewers, report to Director Stirman. Employees work in small groups, and get to know the boss and each other so much better that employee relations have been almost completely rebuilt. The men are happier and do more work and better work. Foremen and superintendents find it easier to chose men for different jobs, train them, and evaluate them. It is easier to watch promising men who can be promoted into more important work.

Costs of operation had been rising steadily year after year under the old plan. Now, for three years, in spite of higher salaries, and higher costs for most materials and supplies, costs have been running level.

The scheme of directing the three outlying centers is not elaborate. Each of the five superintendents at headquarters has a foreman in

● **VIEW through shop at Northeast Center, one of the four service centers located in the city fringes. All are on 25-acre plots, with paved areas and easy access.**

● **STOCK room area at the Headquarters shop. A large inventory is maintained and parts and supplies are fed out to the other centers, utilizing a simplified procedure.**

each of the other three centers, and also a supply man who reports to the main supply man. Each department operates singly, except that all automotive equipment is under the supervision of Lowell Fisher at headquarters. Most of the communications are over the telephone, sending confirmations in formal orders or instructions by mail.

Operation

About 1500 persons are employed at headquarters, in the Southeast Center, but some of these will soon be shifted to the new Southwest Center when it is finished. Each of the small centers has about 500 employees.

The main shop is here. It is equipped to rebuild trucks and machines of all kinds. There are body and paint shops. Heavy welding and fabricating of any kind can be done. A machine shop has lathes, drill presses and other equipment needed for almost any job. The best tools have been provided for every purpose. A traveling electric crane traverses the entire length of the shop, and portable hoists, chain hoists and the like are available for spot work.

Almost any job can be done at the outlying centers, but it is found better to bring heavy or complicated work to the main shop.

The three other centers are not inferior to headquarters except in size. Not as much space is needed for offices and for some functions of administration. The shops are uniformly excellent. At the Northeast Center, for one example, there are 9 stalls in a row for work on trucks, and two stalls for washing. Six mechanics are employed here. They come to work at noon, and remain until 10:30 at night, because the trucks can be brought in for work after noon. In this shop, as in all the others, the back wall is almost entirely glass. Neon lighting makes the room brilliant for night work, and a clear white ceiling reflects the light downward. All the stalls have roll-down doors.

A $100,000 inventory of supplies and parts is carried at headquarters, and there is a generous limit of $10,000 within which any buying can be done to keep the inventory up, or to get parts and supplies in a hurry, without prior approval from any higher authority. Copies of all orders go to the Purchasing Office in the city hall, and then on to suppliers to confirm requisitions.

The continuous inventory is handled on the maximum-minimum plan. Orders are made up automatically for replenishing stocks when items drop to the minimum requirement. In connection with this there is a system of routine checking to determine what stocks are being carried in excess of current needs, especially in items which can be quickly obtained from local manufacturers or dealers. Too low an inventory of any item shows up in the appearance of too many orders, so the stock is increased.

Parts and supplies are fed out to the other centers in a simplified procedure in which orders are automatically checked in and out of the master inventory. All the centers operate pickup trucks for errands and miscellaneous work, and handle the inventory service. In addition, mail is delivered to every center on the early morning rounds.

Over-all Gains

The over-all effect of the new plan on the morale of the organizations is evident everywhere. The designers of the centers could not have started with a better motive than lifting the work attitudes of men employed in the old downtown garage. The cause of the improvement may have to be shared with other aspects of the change, but certainly the bright new buildings, the ordered arrangement for work, the spacious paved areas around the buildings, the clean and well-lighted shops, the orderly stock rooms, and the beautiful offices, must take most of the credit. Pleasant environment is one of the satisfactions sought by discontented employees in almost every labor dispute. They have it here.

A Better Way To Make Street Marking Stencils

TRAFFIC departments in several West Coast cities report that a new material has solved many problems connected with street stencils, the large cut-out letters used to stencil the words, STOP, SLOW, etc., on streets and highways. This material is called Harborite, and is Douglas Fir Plywood with a resin-impregnated overlay that is both tough and smooth. Some of these Harborite stencils have been used for six months and are still in good shape, according to street maintenance men.

The traffic departments of Los Angeles, Long Beach, Pomona, Compton, Newport Beach and Sierra Madre are now using Harborite for street stencils with excellent results. The material is made by Harbor Plywood Corp.

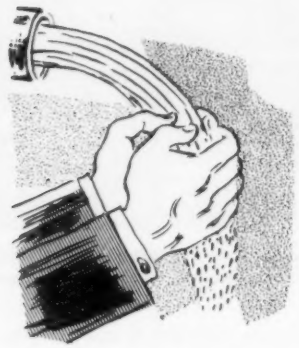
Along with providing a super-smooth surface from which excess paint can be easily removed, Harborite has other advantages to stencil-users. It has rigidity and strength which make it easy to cut and to handle; resistance to water and weather gives it long life; and ability to stand up under rough treatment makes it economical.

Traffic engineers and maintenance men interested in testing Harborite may obtain free samples and more information from Harbor Plywood Corporation, Aberdeen, Washington.

● **THESE durable stencils made of Harborite facilitate street marking.**

COPPER MINING PLANT

SQUEEZES WATER DRY



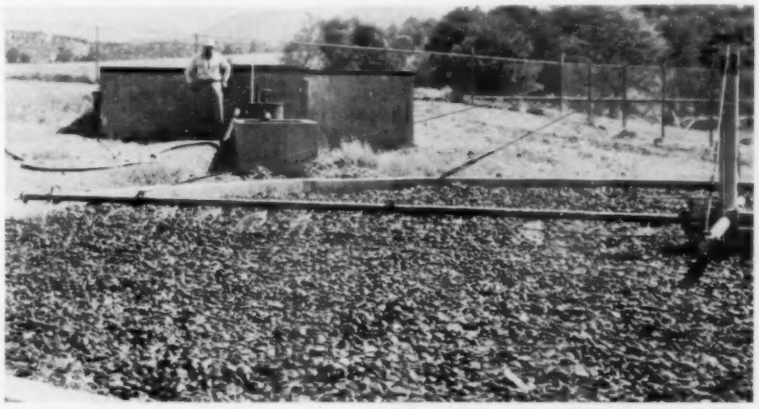
THOUGH richly endowed with gold, silver, copper and other minerals the Southwest is poor in water. Every available drop of water is squeezed to the utmost to operate industries and to meet domestic needs. An example is the methods of water supply and water reuse at Santa Rita and Hurley, N. M., where the Cheno Mines Division of Kennecott Copper Corp. operates a mine, mill, smelter, shops and offices. Hurley has a population served by water of about 2060; Santa Rita has between 1800 and 2000.

Water for domestic use at Hurley comes from thirteen wells ranging in depth from 150 to 300 feet. Seven wells are equipped with Pomona pumps, and there are three Layne and Bowler (of Memphis) pumps, one Worthington and two Kimball Krough. Ten of the pumps are water lubricated and three are oil lubricated. The Warm Springs wells produce 500 gpm; the Starks well 200 gpm; and the Apache wells 600 to 1500 gpm. At Santa Rita the wells are deeper, averaging 1200 feet, and produce less water than the wells serving Hurley.

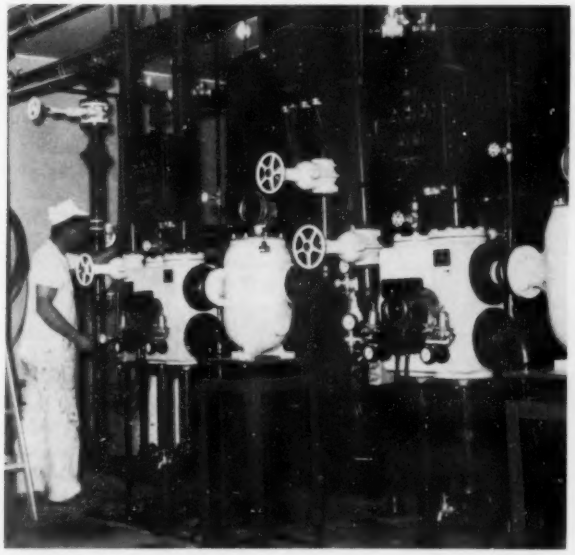
Water Quality

At Hurley the water has a hardness of 10 gpg; Santa Rita water is 20 gpg. Santa Rita uses sodium zeolite softening; Hurley does not provide any treatment other than chlorination. In both places Wallace & Tiernan equipment is used for chlorination.

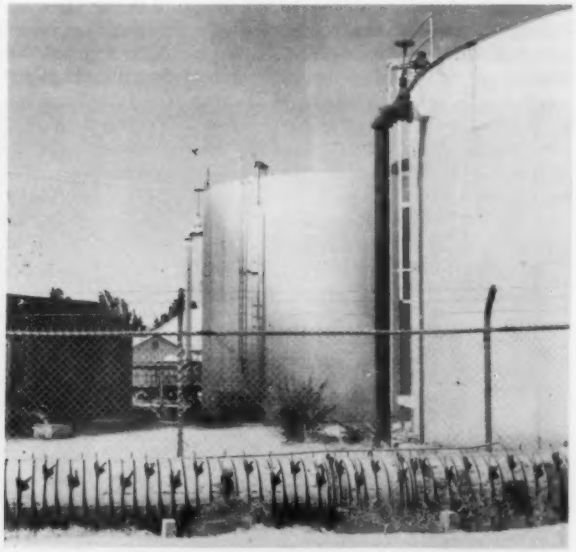
The softening equipment used at Santa Rita is Cochrane. Recharge of the zeolite is automatically controlled by time clock at 5½-hour intervals; from 1800 to 2000 pounds of salt are used daily in the processing of about 550,000 gallons of water; 30 percent of the fresh water is used for industrial purposes.



● **SEWAGE treatment plant near the precipitating plant treats waste from the townsite and shop area. Water then goes to precipitating plant, thence to dumps.**



● **SOFTENING plant at 700 well near Santa Rita treats all water for domestic use and some for industrial operations.**



● **STORAGE tanks at Hurley. Center tank is kept full at all times for fire use. Pumps are housed in building shown at left.**

● RADIO controlled well. Receiver on pole at the left turns pumps on or off by radio signal received from power plant.

● DIESEL engine is used to drive the pump at Stark Well No. 3 until a power line can be brought in to serve this area.

Water needs for Hurley and for the mill amount to about 3500 gpm, with the mill using about 72 percent of the total flow. There is elevated storage to which the water is pumped after chlorination. One 250,000-gallon tank is kept full at all times for fire or other emergency. Water pressure is maintained at 40 to 48 psi.

At Hurley all sewage and all industrial waters are reclaimed for industrial use. At Santa Rita, 20 percent of the water is reclaimed and the reclaimed water is used for leaching of the dumps. About 75 gpm is reclaimed from the sewage flow.

Sewage treatment at Hurley is by septic tanks with provisions for filtration and recovery of the effluent. There are nine smaller septic tanks of 800 cu. ft. capacity each at Santa Rita and also a trickling filter plant serving 500 persons. Salvage methods and filtration are employed to permit continued reuse of the waste water. In general, all water is maintained in a closed reclamation circuit, with loss due only to evaporation and seepage in surface tanks. Such loss may vary from 20 percent to 60 percent from exposed surfaces depending on temperature and other atmospheric conditions. Water at the Santa Rita installations is reclaimed a second time at the precipitating plant. In fact, every possible method is used to conserve water and the technical staff at the Chino Mines Division is constantly searching for new ways to save water. All water taken from the wells is used again and again, until it literally evaporates.

The water system operates almost wholly automatically. Some of the pumps are turned on or off by hand switches where workmen are on duty 24 hours a day; other switches are actuated by floats in the tanks. Some of the well pumps near Hurley are turned off or on by radio signals sent from the power plant.

A Stump Removal Problem Solved

A STUMP CUTTING machine, the Stump-Hewer, was used to remove a stump that measured 46 inches across its diameter at Goffle Brook Park, Hawthorne, N. J., recently.

The stump was in a bad spot to work on as it was close to a body of water and on a steep hill. Bulldozing the stump out would have done a great deal of damage to the surrounding ground and it would have been almost impossible to maneuver a bulldozer in the area. It would have taken a man several days to chop the stump out by hand. The Stump-Hewer took the stump down well below ground level in about 3 hours cutting time.

● STUMP "hewer" solves the difficult problem of removing stumps at low cost.

The cuttings were spread thinly over the grassy area where they will disintegrate quickly. The depression below ground level amounting to six or eight inches was quickly filled in with top-soil and seeded with grass.

The Stump-Hewer is made by the Exeter Co., Bloomfield, N. J.

• • •

Free Parking to Stimulate Downtown Business

Three hours of free parking are permitted in the downtown section of Port Arthur, Texas, as an experiment toward stimulating business. Parking must be in one of the five downtown parking lots, and the parker must have a parking ticket issued by one of the participating business firms, though he is not required to make a purchase.

Roadside WEED CONTROL PROGRAM

L. A. WESTFALL,

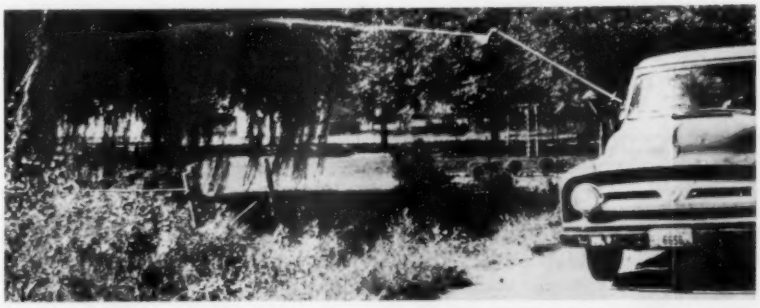
Woodbury County Weed Commissioner
Sioux City, Iowa

ONE OF the five larger counties in the state of Iowa, Woodbury County has large areas of very rough land and several thousand acres along the Missouri river which are low and level and have very little natural drainage. Therefore, our weed and brush situation should be as acute as in most areas; and we think it is.

Roadside spraying is a part of the statewide program to eliminate noxious weeds. The Iowa law says that the control of noxious weeds along trunk and local roads must be carried out by the Board of Supervisors through the County Weed Commissioner. Few roadsides are entirely free of noxious weeds. There are still numerous areas of thistles, bindweed, dock and butter print; and to a lesser degree many other weeds which are classified as noxious. Most farmers are anxious to see weeds eliminated; and since weeds do not stop at fence lines, roadsides must be cleaned up if the noxious weed law is to be enforced.

Complete roadside spraying would seem to be the answer. Some Counties, after two or three years of blanket spraying, have gone back to spot work, as a complete coverage is no longer necessary. Many roadside areas are plagued with sprouts and volunteer brush which tend to increase traffic hazards, cause roads to be blocked by snowdrifts and add to the cost of snow removal and maintenance. These slow up the movement of air so that roads dry off slower in the spring and after summer rains.

The Board of Supervisors are authorized to remove the brush and trees by hand, but costs are estimated to range from $50 to $400 per mile with very little repeat work. If we can get rid of the weed and brush competition, grass will grow on the roadsides. A good cover of grass prevents weed and brush encroachments, cuts maintenance costs and helps prevent erosion.



● **SPRAY RIG in action. A strip 8 ft. wide can be covered by lowering the boom and driving close to the shoulder; and as much as 25 feet by elevating the boom.**

About 50 miles of drainage ditch dikes are sprayed each season. Some of the banks are up to 30 feet to the water line. After four years, part of the banks are well grassed and there is an almost complete absence of brush which had been a problem. About 3 lbs. of 2,4-D acid per mile are used.

For brush foliage spray we use a mixture of 2 lbs. of 2,4-D and 2 lbs. of 2,4,5-T per gal. in 100 gallons of water. Part #2 fuel oil in place of water seems to give better penetration and slower evaporation. Larger brush should be sprayed with a hand gun with a pressure up to 200 lbs. These are wet to the point of run-off.

Through the use of 2,4-D and 2,4,5,-T chemical mixtures, it is now possible to kill trees and brush by spraying during the winter months. Winter applications have several advantages over foliage treatments in that there is likely to be more time, there is less drift hazard and it is possible to obtain a better kill on more species.

Stumps: It is important to cut the brush and trees close. Short stumps are easier to kill and will require less material. We use 1 pint of the mixture of 2,4-D and 2,4,5-T in 10 quarts of fuel oil and apply the mixture with a 3-gallon shoulder sprayer with low pressure. The growing part of older trees is around the outside of the stump. Therefore, we soak the outer portion of the cut well and the bark down into the ground.

Basal: In basal treatment, we spray all around the base of the tree from the ground up 2 feet and soak the bark thoroughly until it runs into the ground, being sure to encircle the tree. A shoulder sprayer is fast and efficient. Many treated trees will develop leaves normally in the spring, but most will die before autumn. Best results have been obtained when the ground is dry so it will absorb more material at the base of the tree.

Our Oliver high pressure 3-piston pump with a 10-gal. per min. capacity and positive agitation in the tank makes this sprayer very adaptable to our different needs. It quickly regulates from 20 lbs. up to 250 lbs. A short Broadjet side boom and spray gun for tall brush or spot spraying makes it quite complete.

The use of good low volatile materials and careful application should keep any crop damage to a minimum. With constant improvement in chemicals and their carriers, and the steady decrease in cost, the control program seems very attractive.

The job of education is never finished. New people, new methods and materials are continually coming into the picture. Any program that pays for itself many times on a current basis, and in addition helps to protect the future productivity of the land, is a good investment.

COUNTY-WIDE PLANNING

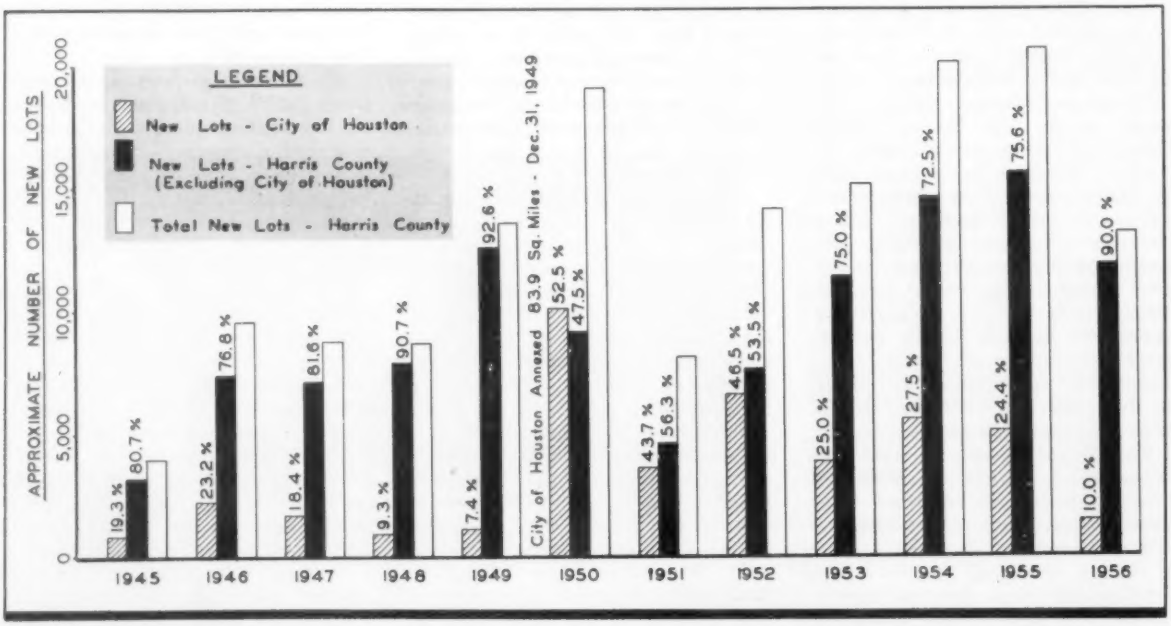
ROGER MOEHLMAN,
Sanitary Engineer,
PHILLIP W. YOUNG,
Asst. Sanitary Engineer,
MERYL L. OLSON,
Junior Engineer,
Harris County Health Unit,
Houston, Texas

THE POPULATION of Harris County, Tex., increased by 607,000 persons or 115 percent from 1940 to the end of 1956. After World War II, when building material became available, large subdivisions in the suburban areas were planned to house the ever-increasing population. Past experience had shown that privies and septic tanks with drain fields were not satisfactory methods of sewage disposal; and with this increase in suburban building, tremendous amounts of disease-laden sewage in our roadside ditches, on the top of the ground, and in the yards of homes could easily be visualized if these methods of sewage disposal continued to be used.

With the cooperation of the subdividers and home builders, public sewerage systems meeting the State Board of Health Standards were installed to serve entire subdivisions and the era of individual sewage disposal for large subdivisions ended. The degree of cooperation of the subdividers and the success of the program is shown by the fact that from 1945 to the end of 1956, 97 sewage treatment plants were constructed in Harris County. Although Harris County and the City of Houston, which is the largest city in the county, have had a tremendous increase in population in the past 10 years, the greatest rate of population growth has occurred outside the city limits of Houston. The large number and the great percentage of lots subdivided outside the City of Houston, from 1945 to 1956, indicate the responsibility that the county had to accept during these years. The fact that this responsibility was successfully undertaken is shown by the fact that the total sewered population, as well as the ratio of sewered population to the actual population in the County outside Houston, increased considerably from 1945 to 1956.

Harris County, slightly smaller than the State of Delaware, is situated on the coastal plain of Southeast Texas. Its elevation varies from sea level on Galveston Bay to approximately 250 ft. above sea level. The average annual rainfall is 45.38 inches with much of this rain coming in the winter months. Houston, with an estimated population of 872,000, is the principal city, but there are 21 other cities and villages in the county, with populations ranging from a few hundred people to over 40,000. These communities generally are located in the fringe areas surrounding Houston, but due to past annexation programs, a few of the cities now lie within the city limits of Houston though maintaining separate and independent governments.

The public health authority for these cities, as well as for the suburban areas of the county, is the Harris County Health Unit. Only the City of Houston and Harris County have completely staffed health departments. Although the Harris County Health Unit has legal authority in the City of Houston, it does not provide public health services to the City. This and similar situations have led to the use of the term "County", which is taken to mean the area within



● **DESPITE annexations by Houston, County development continues to increase, as indicated by chart and text herewith.**

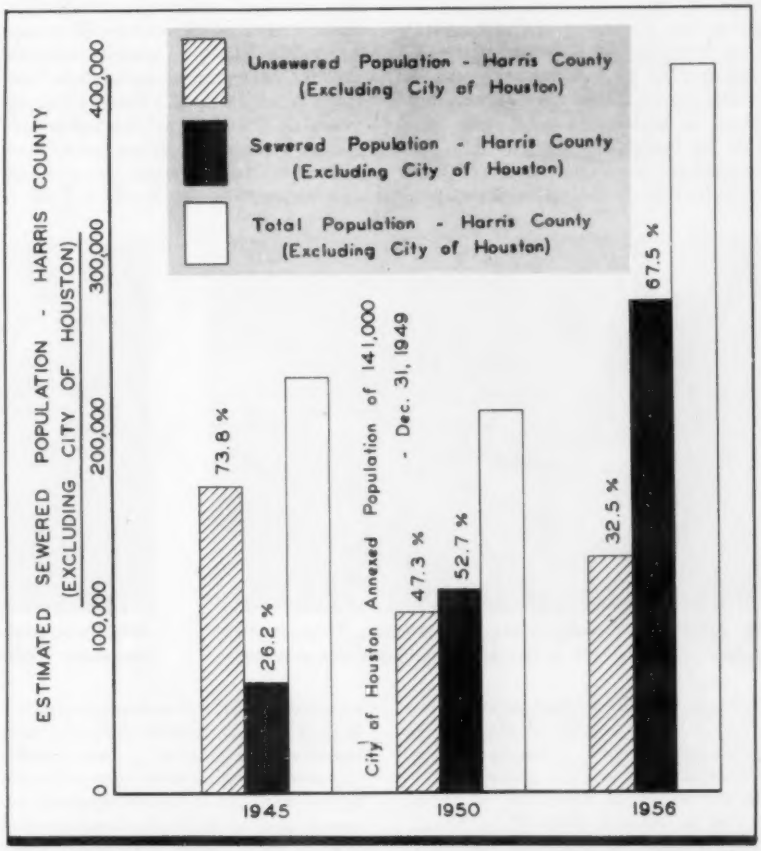
FOR SEWAGE TREATMENT

the County limits, including all cities and villages other than Houston.

In 1945, 750 new lots were formed in the City of Houston and 3150 lots, or 80 percent of the total, in the County. In 1949 new lots in the county reached a high of 12,500, or 92.5 percent of those in the City and County combined. In December of that year, Houston annexed a considerable portion of the populated area of the County, as well as adjoining vacant areas. The percentage of new lots in the County in 1950 therefore fell to 47.5 percent, but by 1955, the new lots in the County had risen again to 75.6 percent of a total of 20,500 in both City and County.

As Harris County does not provide sewerage service, subdividers, developers, and people living in unincorporated areas of the County had to rely on other means of obtaining this service. Two general methods were formation of Fresh Water Supply Districts or of Water Control and Improvement Districts with the power to finance, construct, and operate sewerage facilities. Sewerage facilities also were constructed and operated by individuals or corporations. Incorporated cities in the County generally provided sewerage service to those within their city limits as the subdivisions developed.

Originally sewage collection and treatment were provided only in the large cities and in a few older suburban areas. Elsewhere residents of the County relied on septic tank systems and privies. It soon proved that these did not function properly because of the heavy rainfall in the area (45.38 inches average annual); the dense soil with low-absorbent characteristics; the high water table; poor drainage; and related factors. The failure of septic tank drainfields caused the backing up of used water facilities inside the houses. To relieve these conditions, many people opened their drainfields directly to the roadside ditches. This resulted in the contamination of adjoining areas.



● **TEN YEARS of progress in reducing the proportion of unsewered population.**

Sewage Disposal Policy

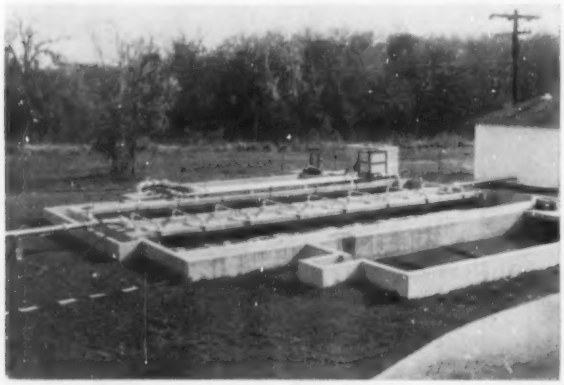
The failure of individual septic tank installations prompted a change in policies as early as 1945. Before that date, septic tanks that met State specifications were approved as a matter of form without regard to whether or not they created health hazards. When it became obvious that these systems created health hazards, although constructed to the best possible standards, it was felt by the Harris County Health Unit that no approval should be given unless all known conditions indicated that the system could work satisfactorily.

This change of policy meant that the Harris County Health Unit would not approve an individual sewage disposal method, and any subdividers or builders who wished to secure FHA approval must connect to an existing sewerage system or construct their own. This policy was later extended to include houses built under Veterans Administration approval, with some modifications. The policy required that plans for collection lines and sewage treatment plants had to meet the approval of the Texas State Department of Health and be inspected by the Harris County Health Unit after the system was constructed, thereby keeping some check on the activities of the builders.

Many subdividers felt they were being severely penalized because of these requirements, but they soon learned that they could install a complete water system and sewerage system at a per house price comparable with the cost of a private well and individual septic tank and drain field. Also, the subdivider still owned the water and sewerage systems and could realize additional profit by operating these utilities. The availability of easier financing through the FHA or VA agencies also made it easier to sell the houses.

In the older areas where previous housing existed, adequate sewage disposal must be provided in order to secure loans under FHA or VA agencies. Sewerage systems in these areas can be installed through Fresh Water Districts and Water Control and Improvement Districts.

There are still many unsewered areas in Harris County. People are either not cognizant of good sanitation practices or have no desire to obtain FHA or VA financing. These areas generally consist of subdivisions in which the subdivider sold lots to individual owners who arranged for the construction of their own homes. Building in these sections is usually a slow process, but over a long period of time these areas have become a health menace. Generally when this happens it is corrected by the formation of either a FW or WCI District. As a result, the number of "unsewered" residences has decreased slightly, while the number of sewered residences has risen steadily.



● ACTIVATED sludge plant for FWD No. 2 serves 4,000 people. It is the first of two plants built for this community.

● SMALL contact aeration plant serves 300 persons in the Longwoods Addition. Operating building is shown at the right.

Design and Construction

Plans and specifications for public sewerage systems are approved by the Texas State Department of Health. Upon completion of construction of a plant, an inspection by the Harris County Health Unit is made to determine if the plant has been constructed according to approved plans. The design of sewerage systems is performed by professional engineers, the Harris County Health Unit's Engineering Division providing consultative service with regard to the type of plant, size of lines, and other design factors.

Location of plant sites has been the responsibility of the owner or his engineer and the selection of a proper site has proved to be a difficult task since it has become apparent that no guarantee can be given of future suitability. Plant locations which appeared suitable when the plant was designed have soon become surrounded by homes. Another site factor is the suitability of watercourses nearby for the discharge of plant effluent. Experience has proved that plant effluents should not be allowed to discharge to small, shallow, poorly drained ditches. Many more complaints have been received by the Health Unit on roadside ditches into which plant effluents discharge than have been received on the sewage plants which discharge to these ditches. This is understandable; the topography of Harris County is relatively flat and the drainage ditches in some areas have very little grade; any obstructions, such as culverts, grasses or weeds and trash, further restrict the flow in the ditches. With the breakdown of any plant unit or poor plant operation, partly treated effluents can be discharged to the ditches, thereby causing sludge banks to accumulate, which create unsightly and odorous conditions. Another disadvantage to the discharge of effluents to roadside ditches is the possible health hazard involved when these effluents flow through populated areas. Also, people are prone to complain when water stands in their front ditches, whether it is polluted or not.

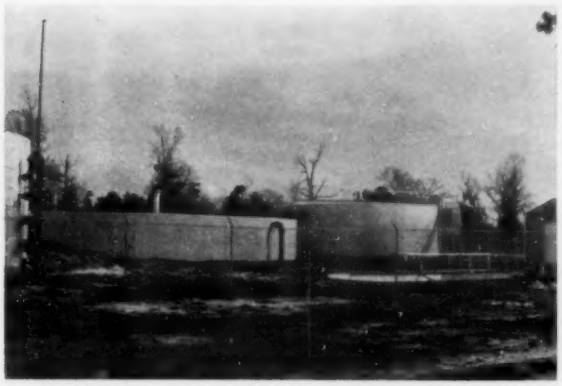
Fortunately, most of the sewage plants are located near, and discharge their effluents to, well-drained bayous and large ditches. These locations will make it relatively easy and economical for the City of Houston or possibly a county sanitary district, which has been contemplated, to extend trunk lines to the old plants so that the sewage can be treated at a few large plants. This was done in some areas by the City of Houston after the annexation of 1949.

Many different types of plants have been constructed, including standard and high rate trickling filters; conventional activated sludge; activated sludge with mechanical aeration; contact aeration; Dunbar beds; and others. Most of these plants are constructed of concrete or steel. Plants constructed of concrete are conventional, but the plants constructed of steel have been an innovation in this area and were allowed on the premise that they were temporary and would be abandoned when trunk lines were extended and sewage from the area served could be treated at large plants. These plants, constructed of steel, have proven satisfactory when given proper maintenance. Most of the metal plants are the high-rate trickling filter type, consisting of a circular Imhoff tank with sludge beds, circular high-rate trickling filter, circular final-settling tank with hoppered bottom, and a chlorine detention tank. Recently other types of plants have been constructed of steel and their merits have not yet been determined. In the county, there are 97 sewage treatment plants ranging in design population from 90 to 42,000 persons. Of these plants, 80 percent have a design population of 5,000 persons or less, and 40 percent have a design population of 2,000 persons or less.

The sewered population in the "county" has continually increased since 1945, and so has the percent of sewered population as compared with the total population of the county. Also the number of sewage plants has increased from 14 in 1945 to 97 in 1956. During this period, the number of plants owned pri-

vately or by corporations increased from two to 56; and those owned by FW or WCI districts increased from one to 23. In comparison, the number of city-owned plants increased by only one, although the design population of these plants increased considerably.

The marked increase in the water districts and privately-owned plants shows clearly that the sewage-treatment plant is replacing the private septic-tank system in suburban subdivisions. Meanwhile, the cities in the county have extended their lines and increased the capacity of their plants to serve the subdivisions within their limits. As an example, in 1945, the sewered population in the cities of the county was 60,000 persons; this increased to 99,000 persons in 1950 and to 167,000 persons at the end of 1956. During the period from 1949 to 1953 three cities in the county won a yearly award for the city in Texas having the highest percentage of population connected to sanitary sewers.



● **TRICKLING filter plant serves 6,000 persons in WC&ID No. 39. Primary settling tank is at right, filter at left.**

● **METAL Imhoff tank serves 230 persons in high-priced subdivision. Filter-sedimentation tank shown in the rear.**

Problems of Operation

After the plant has been designed and constructed, operation becomes of the utmost importance. According to Texas laws, a person who operates a sewage-treatment plant must hold a certificate of competency issued by the State Department of Health. As it has been rather difficult to find qualified operators, many operators have been trained initially to operate only one particular type of plant, but are expected to be qualified promptly for a certificate. As an operator must use every means available to him to procure a satisfactory effluent and to keep odors at a minimum, a properly trained and educated man is a necessity in the type of program undertaken by Harris County.

From time to time, operation of the plants is checked by visual inspection and by sampling of effluents from various units. Sampling procedure is carried out according to the needs, from 24-hour composite samples collected from all units to grab samples of the final effluent. A 5-day BOD and suspended solids, plus pH, is usually performed on each sample taken. In 1953, a complete efficiency study was made by the Engineering Division of the Harris County Health Unit of all plants in operation in the county. At least one 24-hour composite sample was taken from the various units of each plant. At that time it was determined that 59 county plants were treating a total of 9,190,000 gallons per day and had an average efficiency of 80 percent, with individual efficiencies ranging from 51 percent to 99 percent. These studies resulted in corrections at plants which were deficient in operation or equipment, and since that time better operation, additions to new plants, and entire new plants have been obtained. It is felt that the efficiency of treatment has steadily increased. In part, this has been brought about by consistent checks on plants and by providing as much assistance in operation as possible. Each operator is urged to provide a laboratory to perform the tests needed for his particular type of plant and to check the efficiency of operation. In the construction of recent plants, laboratory facilities have usually been included; however, the need exists for periodic efficiency studies by an unbiased, competent organization.

Operator Training

To assist the operator in obtaining the required schooling for certification, sewage-treatment courses, including laboratory control, are provided by the Texas Engineering Extension Service through itinerant instructors. In addition, courses in sewage treatment theory and practice are offered at a minimum charge in an annual Short School sponsored by the Texas Water and Sewage Works Association. These courses have been of great value and interest to the operator, as shown by the large number of persons who attend the courses and by the improved operation of the plants.

It is indicative of the interest taken in sewage treatment that the cup presented annually at the short school, held at A & M College for the plant having the best effluent in Texas, has been won by plants in the county three times in the last nine years.

Other Problems

Problems other than plant operation have been encountered in our program, and these problems with our methods of correcting them may be of value to others who have a similar program. As mentioned above, overloading of the plants has been at a minimum. A careful check is made on the plants to determine the number of connections or people being served, and whenever the plant approaches design load a letter is sent to the owner requesting that additional facilities be provided. If additional treatment facilities are not contemplated or in the construction stage at the time the plant reaches its design load, a letter is written to the owner requesting that no more connections be made until added facilities are provided. Copies of this are sent to the FHA and VA agencies. This generally results in no further loans being approved by these agencies in the areas served by the loaded

plant; therefore, in most instances the plants have not been seriously loaded above capacity. If the above procedure does not give the desired results, then the stream pollution and nuisance laws of the State can be used.

Breakdowns and resultant nontreatment of sewage are among the major problems encountered. Because of the location of the plants with regard to the houses, long breakdowns cannot be tolerated, and repairs must be expedited in order not to cause a nuisance or health hazard.

It was found that, where constant watch is not kept over the plants, especially those located in remote places, operation may be poor, with low efficiency, unsightly conditions and general deterioration of the plant. Upon finding these conditions, proper recommendations are made; and inspections are stepped up to deter possible reoccurrence. Since a number of homes have been built adjacent to and surrounding many of the plants, odor control is a continuous problem. This means that the operator must keep the plant clean at all times and may use odor control methods, such as chlorination, in the various units of the plants; water sprays must be used continuously on some plant units. Where good housekeeping and other methods have not given complete satisfaction, commercial odor-counteracting agents have been sprayed into the air. All in all, considering the number of plants and the complaints received, the operators have done a wonderful job in regards to odor control.

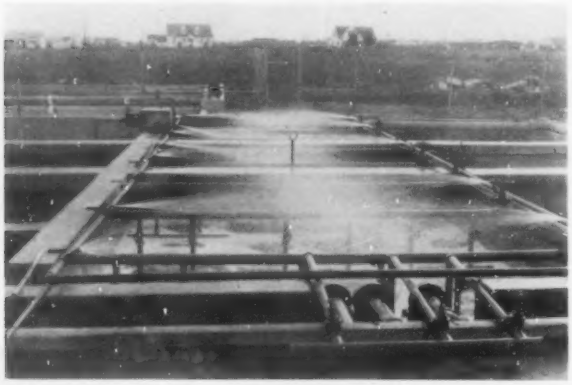
Closely related to odor control are the foam problems encountered with aeration processes. Without controls, this foam tends to blow about the plant area and, when dry, creates black deposits. These deposits are unsightly and may develop odors if not removed. This foam is usually controlled by continuous water sprays, but sometimes chemical defoaming agents are used.

The importance of disinfection of final effluents from sewage-treatment plants cannot be over emphasized, especially where the plant effluent flows through populated areas. For this reason, good operation and control of chlorination equipment and the maintenance of an adequate chlorine residual in the final effluent are required.

Another problem has been the difficulty of convincing various owners and agencies of the desirability of combining subdivisions in the same area into one sewerage system. In many cases this could have been done easily in the initial stages of planning, resulting in an overall lower original cost as well as future economy in operation. In the last few years, more has been accomplished in this line and several subdivisions are now jointly served.

It is realized that the establishment of many small sewage treatment plants where one or more larger plants could serve the same purpose is not desirable. These types of units are in reality only a step above septic tanks and should be used only in lieu of the availability of other methods. In such areas as Harris County, and in others with typical growth, they can be of great value though it is realized that an overall master plan would be the desirable solution to our problems. This has not presented itself in such a way that the plan could be made and brought to a realization.

At the time that this article is being written, the City of Houston has again annexed an area that doubles its present area. This annexation program may well serve as a means to eliminate many of these small systems. However, even now, it is planned that more small sewage treatment plants will be built outside of the new city limits of Houston; and, looking into the future, it is hoped that these plants will have refinements that existing plants do not now have. All in all, the program in Harris County has had a great deal of effect; and, even though no official statistics are available, it is known that many health hazards and individual sewage problems have been eliminated.



● **FOAM on aeration tank is well-controlled by use of water sprays. Foam is a nuisance under Harris Co. conditions.**

● **PORTION of the laboratory at the Bellaire sewage treatment plant, showing equipment needed for routine testing.**

Zoning for Population Density Control

A court has upheld an ordinance in Eatontown, N. J., providing for residential development on lots of one acre, 32,000 square feet, 20,000 square feet, and 11,000 square feet ([*Clary v. Borough of Eatontown*, *124*] Atlantic (2d) 54), according to Public Management. The court held that control of population density is a proper zoning objective and that the intangible object of community attractiveness is appropriately to be considered as part of the general welfare. In answer to the argument of economic segregation from varying lot size requirements, the court stated that "a high-class residence district is as essential to the local economy as multi-family and apartment house areas. Each has its place in a well-rounded municipal development; each has its part in a comprehensive plan for the utilization of local facilities."

DRIVER TRAINING IN PUBLIC WORKS

RICHARD GALLAGHER,

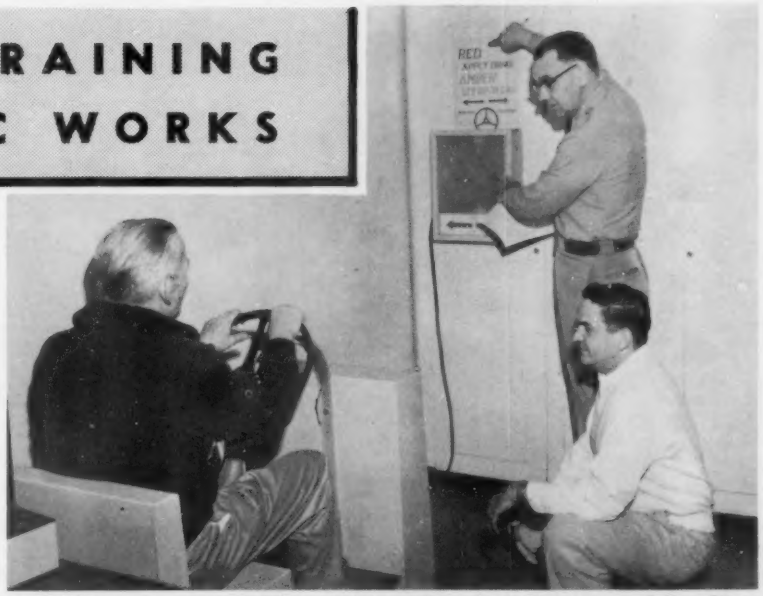
Director of Public Works,
and

L. E. McCORISON,

Superintendent, Equipment Division

Department of Public Works

San Diego, California



● **BRAKE reaction test is being administered by Fred Christensen of San Diego Police Department to a driver training class member. Bob John checks performance.**

DURING THE PAST two decades, we have witnessed a tremendous increase in the number of vehicles using the streets and highways of the nation. This increase has been accompanied by an alarming number of vehicular accidents. Many agencies and corporations have taken affirmative steps to promote safe driving and road courtesy. This is particularly true among private fleet operators, including over-the-road haulers, milk transfer and delivery, parcel delivery, bakery route operators and bus fleets. Along this same line, our public schools are playing a most important part in the effort to improve driving ability of the young citizen by offering courses in driver training.

However, many of the employees using governmental equipment have not had the advantage of any type of formal driver training. It is evident that an on-the-job type of instruction is necessary to reach these drivers.

The Department of Public Works of the City of San Diego consists of approximately 1,000 employees distributed among seven divisions: Administration, Street, Sewerage, Sanitation, Public Buildings, Electrical and Equipment. In addition to vehicular equipment operated by Public Works employees, the Equipment Division is responsible for the maintenance and repair of vehicular equipment operated by all other City Departments and Divisions with the exception of Police, Fire and Harbor Departments. Therefore, the approximately 800 pieces of self-powered equipment maintained by this Division serve the needs of about 2,300 employees. Of this number, about 860 employees actually operate vehicular equipment with any appreciable degree of frequency.

About four years ago, a Public Works Department Vehicular Accident Review Board was established to review all chargeable and preventable equipment accidents. The Board reviews the accident with the employee involved and his supervisor. The Board's main purpose is to point out ways and means of avoiding or eliminating accidents, rather than to determine the extent of any disciplinary action to be administered. However, if the driver's past record and the circumstances of the most recent accident indicate that he should be penalized, a recommendation to this effect is sent to the driver's superintendent. Accident Review Boards are generally recognized as being constructive in their approach to the reduction of traffic accidents. However, of necessity, they are restricted to a "backward" look.

Driver Training Programs enable a "double-barreled" approach in that they encourage proper driving to prevent accidents and to reduce wear and tear on equipment. Accordingly, in March, 1955, the Director of Public Works requested that a formal driver training program be developed and placed into operation by the Equipment Division.

The objective in this training is to cover the following four general areas:

1. Determination of the capabilities of the individual driver.
2. Explanation of the driver's responsibilities regarding equipment operation.
3. Explanation of defensive driving procedures.
4. Instruction in the purpose and functioning of the operating parts of the vehicle.

A five-hour trial course was developed, and the first group of forty men completed training in December, 1956. All training is being done by Larry Seaman, Equipment Division General Foreman; Bob John, Equipment Division Dispatcher; and, James Gleason, City Safety Officer. The results were especially encouraging. Drivers not only show a high degree of interest in the train-

● **CLASS members are shown how the power train and clutch mechanism works.**

● "BEFORE Operation" inspections are included in the training program. Classes are held once a week and are scheduled for the most convenient time for trainees.

ing, but many of them have volunteered the information that they have learned more about the operation of a vehicle, and about their responsibilities as drivers, than they had in all the years they had been operating City equipment.

As a result of the training experience gained and the comments of the members of the pilot class, the course has been revised to include seven one-hour sessions as follows: (1) Visual Acuity and Reaction Test; (2) Defensive Driving Tactics; (3) Driver Responsibility; (4) Operations Inspection; (5) Power Train and Clutch; (6) Brake System; and (7) Steering gear, and review of entire course.

Training classes are held once a week, and are scheduled at the most convenient time for the Division concerned. Extensive use is made of training aids, including mock-ups and cutaway models of the operating parts of a vehicle. In addition, much of session No. 4 on operations inspection is conducted in the field with a piece of equipment picked at random. This piece of equipment is the same type operated by most of the class.

Driver training is of greatest value when it is patterned to meet the particular problems of the group of drivers involved. In our case, drivers were first categorized into three classifications: (1) Those whose primary job is driving; (2) Those who drive regularly in order to perform their assigned task; and (3) Those who drive occasionally.

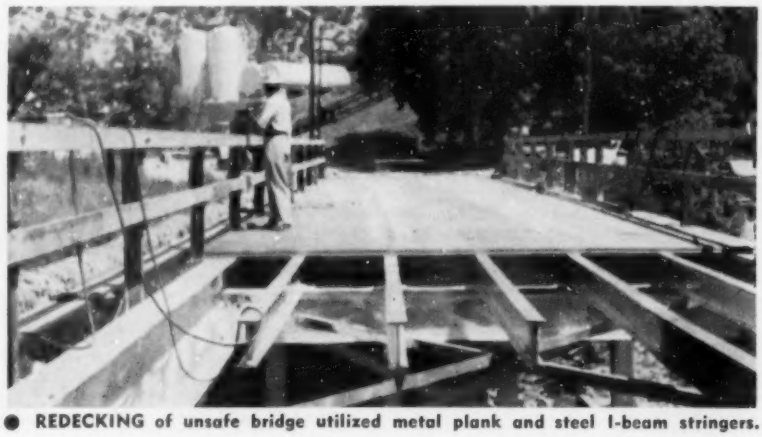
The same general information is given to all three categories, but the emphasis is varied according to the category and the type of vehicle operated. For instance, the drivers of our refuse collection trucks fall into category (1). They are treated as professional drivers, emphasizing defense driving tactics and road courtesy, and the mechanical aspects of the power train and foot brake system.

It appears that the best response will be with classes limited from fifteen to twenty drivers who operate the same type of equipment, and who are in the same driving classification. Program results, thus far, have been quite promising, however, we believe even greater benefits will result as the drivers are brought in for shorter, "refresher" courses. It is the plan to give each driver a refresher course approximately one year after completion of the regular course, and then bi-annually thereafter.

Bridge Redecked in Fast Time

WHEN a city plays host to many tourists and a weak bridge connects a large resort area to the main highway, something must be done about it and done quickly. This was the problem faced by the city council of Glenwood Springs, Colorado. The existing bridge over the Roaring Fork River had a wood deck on timber stringers which had deteriorated to the dangerous stage. The bridge is 16 feet wide and 220 feet long.

A metal bridge plank on steel I-beam stringers was used to redeck the bridge. Construction had to be completed quickly because the work was to be done during the height of the summer tourist season. Armco Drainage & Metal Products, Inc., supplied 3,250 sq. ft. of 12-gage corrugated bridge plank. The bridge was closed to traffic at 8 a.m. on July 24. The contractors removed the old decking and stringers, replaced them with steel members, and reopened the bridge to traffic at 5 p.m. on July 27. Two days later it was closed again for a few hours while a pavement was placed.



● REDECKING of unsafe bridge utilized metal plank and steel I-beam stringers.

FRESH WATER FROM SALINE SOURCES

by the Electric Membrane Process

WILLIAM E. KATZ,
Ionics, Inc.

THE PUBLISHED literature in any fast-moving technical field lags behind the real state of progress. This is particularly true in the desalting of saline water by electric membrane equipment. Desalting plants are more attractive economically, better seasoned by field operating experience, and commercially available in a wider range of types and capacities than is generally realized. The term "desalting" is used generically in this article. In addition to sodium chloride, electric membrane plants remove hardness, alkalinity, gypsum, fluorides and other dissolved solids.

Electric membrane plants have now been tested in more than 50,000 hours of operation in plants located from Hawaii to the Persian Gulf. Although most economical in the brackish water range (1000-5000 ppm), they have performed well on Texas radar towers (the Atlantic Ocean is 35,000 ppm) and are being tested for submarine use. In the brackish water range, large-scale plants have broken two cost barriers for water demineralization with operating costs of less than $1 per thousand gallons and investment costs of less than $1 per gallon of daily capacity.

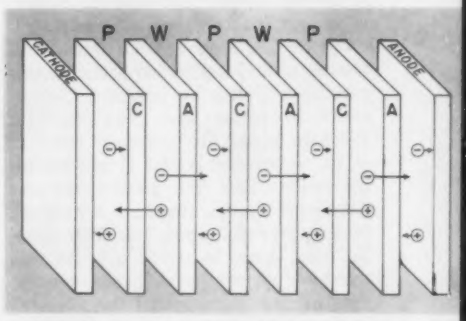
The largest plant to be sold to date by Ionics, Incorporated, Cambridge, Massachusetts, is an 86,400-gallon per day unit consigned to the Bahrain Petroleum Company, Ltd., to supply the refining community at the Bahrain refinery. Bahrain Petroleum is an affiliate of the Cal-Tex group of companies.

As can be expected, one of the best markets for the electric membrane plants is the water-short Middle East oil zone, where several plants are now in operation. At the same time, electric membrane plants are now in service in Montana, Colorado, New Mexico and Texas. Ionics manufacturing facilities have now reached the point where it can provide firm bids on plants in the million gallon per day range.

Operating Characteristics

A brief description of the operating characteristics of electric membrane plants helps explain their flexibility and versatility as well as their economical operation.

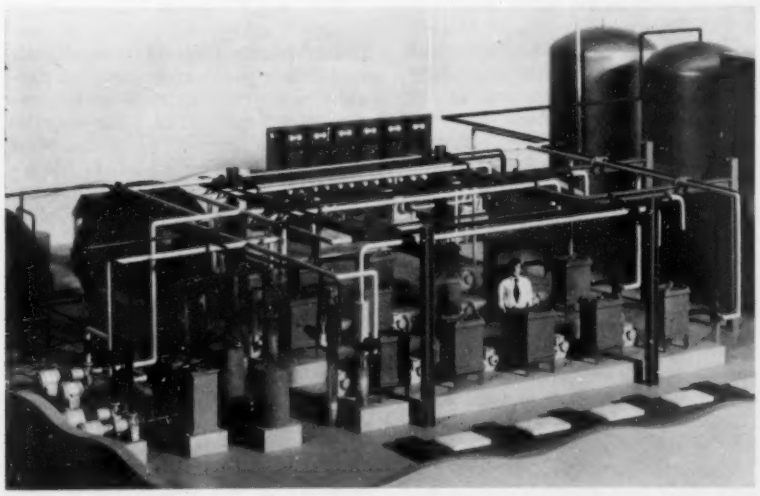
Electric membrane plants take advantage of the fact that molecules of salts and minerals dissolved in water break into ionic halves. Sodium chloride exists as a positively charged sodium ion and a negatively charged chloride ion, and other salts and minerals break into similar ionic pairs. Since water molecules do not break into ionic halves, a direct current passed through a salty solution will excite the ionic pairs and propel them through the water while the water molecules remain unaffected. Ionics has invented and patented a method of producing ion exchange resins in thin sheets—the ion exchange membrane. These membranes separate the freshened water from the salt which is moved through them to be continuously flushed away as brine ("blowdown.").



● **FIG. 1. C and A show the location of the cation and anion exchange membranes. P indicates the product water.**

Figure 1 shows how the membrane stack is assembled to concentrate salt in alternating compartments, while neighboring compartments are freed of their salt components. The basic electric membrane stack contains 300 membranes arrayed horizontally with 1-mm spacing gaskets between membranes. The only external connections required are water lines and direct current electricity (usually obtained from a dry rectifier) to move the salt. Flow rate through the basic membrane stack is 1200 gallons per hour of product water per hour. Voltages range from 100 to 300; currents from 5 to 50 amps.

Ionics manufactures two types of membrane plants. The B-series is designed for production of less than



● **MODEL of Bahrein installation which consists of three parallel banks of five stacks each. This converts 3100-ppm water into a product under 450 ppm salinity.**

28,000 gallons per day, particularly for sea water and feed waters with widely varying salt content. By a simple dial setting, product water of any desired purity is obtained through recycling feed waters from a tank through the membrane stack. Additional capacity of B-series units is gained by adding membrane stacks in parallel.

C-type units are designed for high capacity continuous output with relatively constant input water salinity. Each pass through a C-type unit removes 40 percent of the salt, and large capacity plants can be built up by hooking C-type units in series and parallel. The Bahrain plant, for instance consists of three parallel banks of five stacks in series. The five passes convert 3100-ppm feed water into a product of less than 450 ppm. The fifth stack in each line is used to maintain product purity when one of the five in line is removed for maintenance. The plant thus has a very high service factor (recently better than 98 percent). Water produced by this method tastes good since the water retains its aeration as well as sufficient minerals to avoid the flat taste of distilled water.

A 2-million gallon per day plant to treat brackish water of 1500 ppm (fairly common in our Western regions) would require only two passes through the C-type units which would contain 140 stacks in 70 parallel banks of two.

The unit structure of the plants built up around the basic 1200-gph unit makes its expansion remarkably simple. Electric membrane plants may be permanently installed or trailer-mounted.

Operating Costs

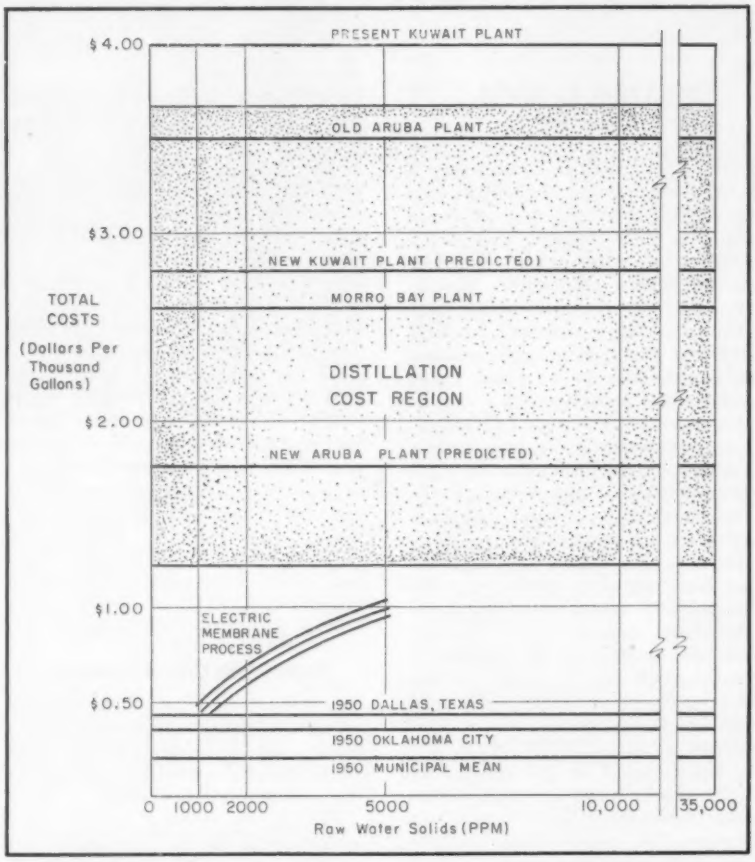
The principal operating costs in electric membrane desalting are electricity and replacement of membranes. Since the plants are automatic in operation, labor costs are low. Attendance may be confined to a single shift in an around-the-clock operation, and highly skilled personnel is not required for maintenance operations.

The cost of electricity per thousand gallons varies with the salinity of feed and product water and the cost of electric energy. Total requirement for pumping and feeding electricity to the rectifiers is about 7 kilowatt hours for each 1000 parts per million removed from 1000 gallons of water. The Bahrain plant, for example, requires about 15 kilowatt hours of electricity per 1000 gallons of water.

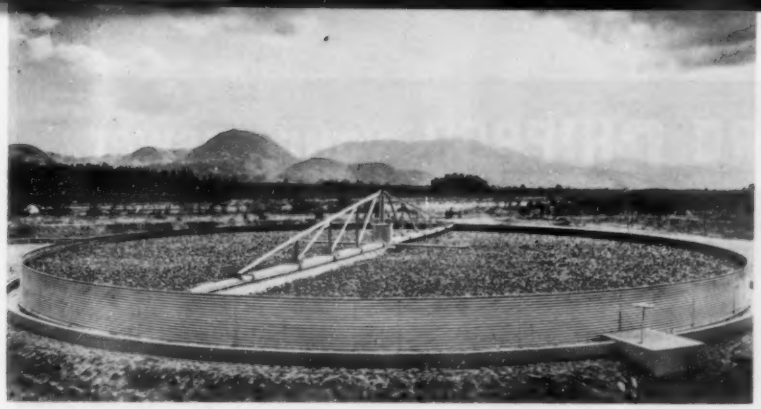
Membrane replacement also will vary with the salinity of the water. Replacements in the Bahrain plant are expected to be less than 50 cents per thousand gallons. In large plants operating on the 1500-1800 ppm water common in our Western states, the replacement cost is expected to run as low as 15 cents per thousand gallons, with total costs, including amortization of investment of 42 cents per thousand gallons.

As mentioned earlier, electric membrane plants can desalt water and produce high potability water at total operating costs of less than $1 per thousand gallons and investment figures of less than $1 per daily gallon of capacity. Figure 2 shows the cost per thousand gallons plotted against the parts per million of dissolved solids. Also shown are reported costs of modern distillation plants, as well as total costs for water purification and distribution for Dallas and Oklahoma City. These two cities were selected because their new modern plants are more nearly representative of today's costs for purifying and distributing water from conventional sources; and because they are aggressive, fast-growing cities in an area that has already turned to untreated brackish waters to supplement fresh water supplies.

The investment costs per daily gallon of the Oklahoma City and Dallas plants indicate that electric membrane plant costs are comparable with conventional water replacement costs. The time may be near when some cities in the West will find it economical to desalt nearby brackish water sources rather than pursue more distant and less promising sources of surface water. The great flexibility of electric membrane plants can be put to good advantage by combining output with water from conventional purification plants. Since the cost of electric membrane demineralization is proportional to the amount of salts removed, water with up to 1000 parts per million of dissolved solids could be mixed with a larger quantity of salt-free water to produce an economical and potable mix.



● **FIG. 2. Operating costs per thousand gallons are plotted against the ppm of dissolved solids in the water. Some costs for Dallas and Oklahoma City are shown.**



● **BIOFILTER at Fillmore, Calif., is 100 feet in diameter. The walls are of 12-gauge asbestos bonded sheets. The horizontal corrugations add to the appearance.**

BIOFILTERS

with Corrugated Metal Walls

HARRY N. JENKS,
Consulting Sanitary Engineer,
Palo Alto, Calif.

BASIC FEATURES of the activated sludge process and of conventional trickling filters are combined in biofiltration, resulting in both economy of construction and economy of operation. Biofilters are relatively shallow—as little as 3 ft. in depth above the filter underdrain system. Recirculation of the filter effluent to the primary settling tank, or of the effluent from the secondary tank to the filter, or of both in two-stage plants provides almost any desired degree of treatment.

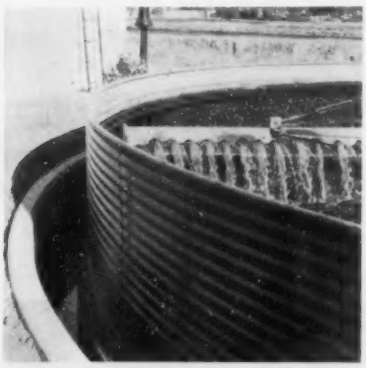
Structurally, the shallow depth of the biofilter has made possible a new type of construction for the biofilter bed enclosure. In 1936, the city of San Mateo, Calif., built a two-stage plant to reclaim irrigation water from sewage. A novel design feature of this plant is the use of corrugated metal filter bed enclosures instead of the conventional concrete walls. These are constructed of 16-gage Armco galvanized sheets rolled in the form of a circle having a 15-ft. inside diameter. The sheets are 4 feet in height. Each of the circular rings is comprised of two horizontal courses. The encircling corrugations are attractive and modernistic looking.

Three years later, in 1939, the city of Lakeport, California, restored a 2-mile lakefront to recreational use by constructing a new treatment plant. The biofilter beds are formed by two horizontal courses of standard 16-gage Armco galvanized sheets curved to a 36-ft. diameter circle. Sheets were delivered to the job site punched and match-marked for cold field riveting. The upper course was designed to overlap the lower on the inside to prevent drippage. The bottom edge of the ring was stiffened by attaching a 1½ by 1½ by 5/16-inch angle. The top edge is finished with a standard 1¼-inch galvanized iron slit pipe fitted over and welded to the sides.

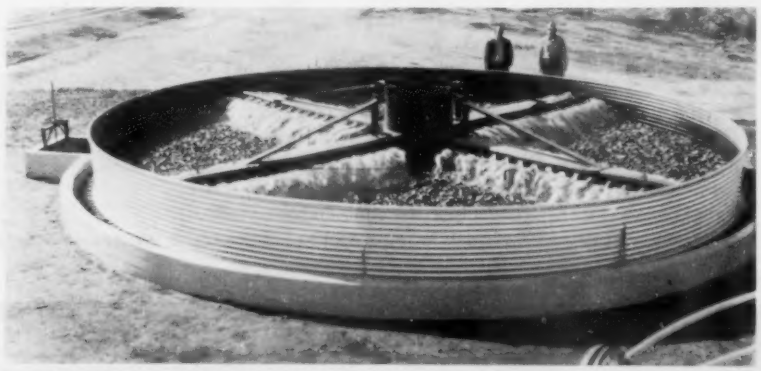
The filters at San Mateo are protected on the inside by bitumastic coal tar paint with aluminum paint being used on the exterior. Only maintenance required is an occasional coat of exterior paint. The filters at Lakeport were given an initial protective coating the same as the San Mateo filter. The second coating of paint was not needed until 1955, sixteen years later. Both installations are in good condition and the overall performance is most satisfactory.

Another biofilter with a metal wall was built in Fillmore, California, in 1955. It is 100 feet in diameter and constructed of 12-gage Armco asbestos-bonded corrugated sheets. These sheets were used for added structural life, based on the durability record of the material. For extra rigidity, 2 by 2 by ¼-inch angles were used on the bottom edge of the enclosure, while 1½ by 1½ by ¼-inch angles were fastened to the top edge.

In general, the corrugated metal biofilter enclosures are particularly well suited to medium sized and small plants. Use of corrugated metal enclosures with possible savings in wall construction cost up to 20 percent over concrete is a direct result of the shallow 3-ft. depth inherent in biofilter design.

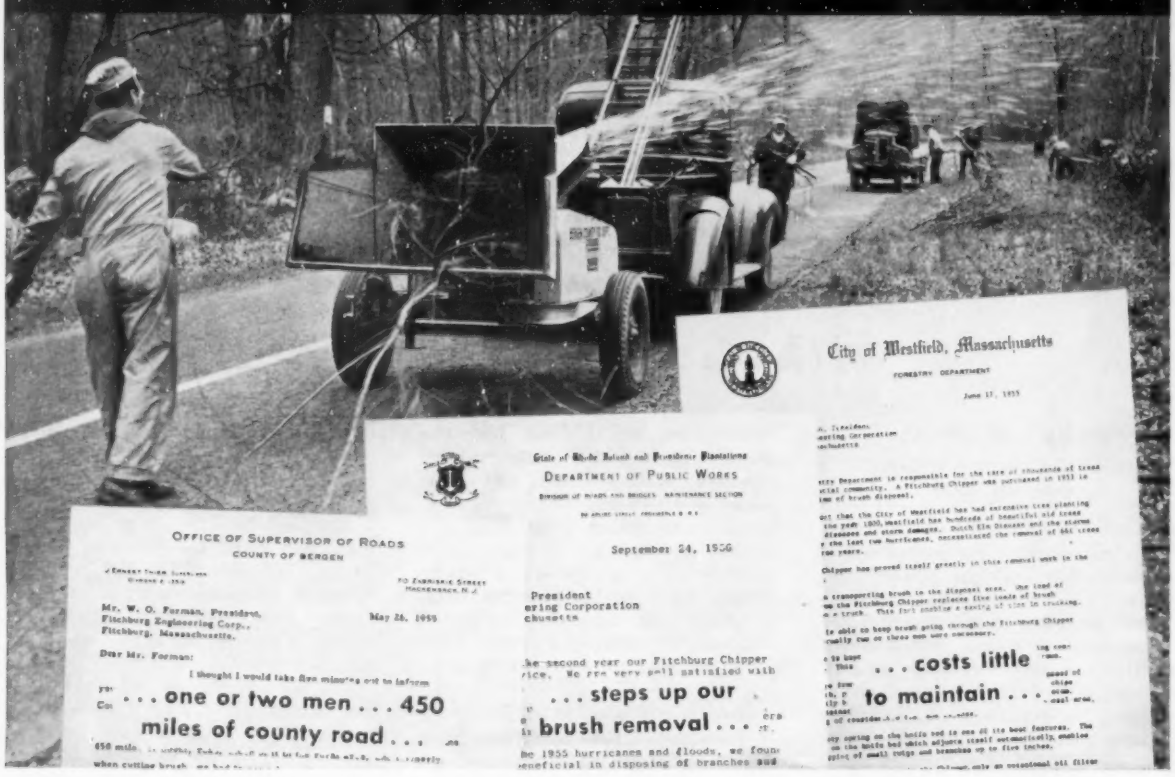


● **CLOSE-UP showing distributor arm, surrounding channel and corrugated wall.**



● **THIS is a new Superate type of biofilter, using a very high liquid loading. Installation was made at New Pismo Beach, Calif. Filter is only 30 ft. in diameter.**

Is a FITCHBURG CHIPPER your answer to speedy, economical brush removal?



A City, a County, a State have found the Fitchburg Wood Chipper to be their answer to difficult brush removal. These short quotations from out of many testimonial letters show how quickly Fitchburg can solve a difficult municipal expense—brush removal.

City of Westfield, Massachusetts:
"costs little to maintain."

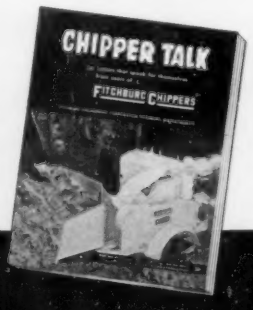
Bergen County, New Jersey:
"one or two men . . . for 450 miles of County Road."

State of Rhode Island:
"steps up our brush removal."

Your City, County, and State, too, can discover these advantages when your maintenance crews use Fitchburg Chippers. Brush crews like the safety of the patented safety spring-activated feed plate—a Fitchburg exclusive—that adjusts itself automatically when brush is fed into the Chipper. They use the disc-clutch that gives Fitchburg a fast stop-start for added safety. Park crews find that Fitchburg's low maintenance, normal lubrication, and tough, chrome steel knives hold their keen edges to keep their chippers working . . . fast!

Look to Fitchburg when you need brush chippers. Check Fitchburg's One Year Guarantee . . . Fitchburg's overall specifications. See the safety features . . . the rugged construction built for long, hard-working service. Your city, county, and state maintenance crews will speed up their brush removal. Make a Fitchburg Wood Chipper your answer to difficult brush removal.

FREE PORTFOLIO
"Chipper Talk"
Complete cutaway color drawings of Fitchburg Chipper in action. Specifications. Photo copies of letters from municipalities, commissions, counties, contractors, tree care men. Write today. Dept. PW-67



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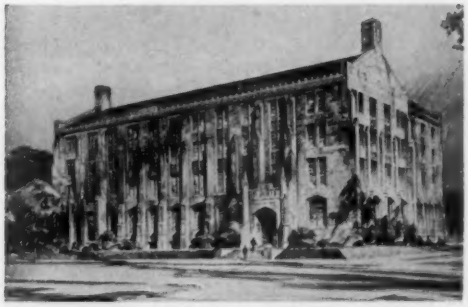

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Michigan Chapter Sponsors Sewer Inspector's School

The Michigan Chapter, American Public Works Association, sponsored a School for Sewer Inspectors in Detroit on March 28th and 29th. Originally scheduled as a one day school on March 28th, it was necessary to repeat the course on the 29th to handle the large advance registration. Approximately 90 persons attended the school on each day. Inspectors from 30 governmental agencies and 10 consulting engineering firms attended the school which was conducted jointly by the Concrete Pipe Association of Michigan and the Clay Sewer Pipe Association. The sessions were held in the Recreation Hall of the Detroit Public Works Department's Michigan Avenue Yard.

The program covered the manufacture, inspection and testing of pipe, trench conditions, bedding and backfill, joints and maintenance. Displays of sewer pipe and joints were set up by local manufacturers who were present to answer the inspector's questions.

The participants in presenting the school were Barney Ross, Engineer of Tests, Wayne County Road Commission; Sherwood Borland, Chief Engineer and C. J. Bauer, District Engineer, both of the Clay Sewer Pipe Association and H. M. Hultquist, Managing Director of the Concrete Pipe Association of Michigan.

● A SESSION at the Sewer Inspector's School sponsored by the Michigan Chapter.

Approve Recommendations of APWA-AGC Joint Cooperative Committee

A standard specification covering responsibility for utility installations affected by the construction of public works projects, prepared by the Joint Cooperative Committee of the APWA and the Associated General Contractors of America, and several important recommendations of this Committee were recently approved by the Board of Directors of each organization. This specification provides for notification of utility owners prior to receiving bids for work, cooperation between contractor, city and utility owner, protection of utilities on the part of the contractor and prohibits interruption of service functions without first obtaining the consent of the owners. Certain obligations on the part of utility owners are also established by this specification which is available upon request to the headquarters in Chicago.

The Board also endorsed the Committee's recommendation that contractors should not be required to fulfill a maintenance guarantee clause if the city writes detailed specifications for a project and requires the contractor to adhere strictly to the specifications. The point stressed by the Committee is, that the party that specifies how the work is to be done should assume responsibility for the results. If the city is not willing to do this, it should use a performance type specification and simply indicate what is desired and let the con-

tractor assume full responsibility for determining how the work should be done to produce the desired results. A maintenance guarantee clause would, of course, be in order if the latter procedure were followed. It should be noted that the Committee's recommendation pertains only to maintenance guarantees and not to material and workmanship guarantees.

The following recommendations of the APWA-AGC Joint Cooperative Committee were also approved by the Board of Directors of each organization: (1) That plans and specifications drawn by consulting engineering firms for municipalities automatically become the property of these municipalities upon their completion by the engineering firm; and (2) that deposits for plans and specifications required by municipalities or consulting engineers representing those municipalities be set at actual reproduction cost for which there should be no refund.

Lyall Pardee, City Engineer of Los Angeles, California and C. Russell Ralph of the Kaw Paving Company of Topeka, Kansas are Co-Chairman of the Joint Committee. APWA members of this Committee are: David Mann, Director of Public Works, Niagara Falls, New York; Roy McLeese, City Engineer, Salt Lake City, Utah; Jean Vincenz, Director of Public Works, San Diego County, California; Walter Savage, Director of Public Works, Orange, New Jersey; David Smallwood, Commissioner, Department of Streets, Philadelphia, Pennsylvania; Milton Rosen, Commissioner of Public Utilities, St. Paul, Minnesota and D. F. Herrick, Executive Director of this Association. AGC members of the Committee are: Albert D. Blakeslee, New Haven, Connecticut; Henry Bok, New Orleans, Louisiana; James Drake, Minneapolis, Minnesota; V. B. Higgins, Greensboro, North Carolina; F. S. Oldt, Dallas, Texas; Weldon Richards, Berkeley, California; J. A. Thompson, Inglewood, California and James Sprouse of the AGC headquarters staff, Washington, D. C.

New Brush Cutter Simplifies Roadside Maintenance

J. FRANCIS GRANGER
Superintendent of Streets,
Marlboro, Massachusetts

ROADSIDE park and playground maintenance in Marlboro has been simplified, and costs greatly reduced, by using the Rowco Brushking. This portable brush cutting machine has brought about savings in labor and has permitted speedy and efficient maintenance operations. The Brushking is a portable, gasoline powered machine, which we have found easy and safe to operate. We use it for cutting light growths between the edge of the pavement and the road boundaries; but in addition to clearing brush, it will cut very hard woods such as honeysuckle and creeping juniper. For this roadside work, it is especially handy because it can be used overhead for limbing and trimming and it will also reach down into ditches and along stream banks.

In our work, we have found that use of this machine greatly reduces the working time formerly required with hand tools. Actually, it takes a worker on a Brushking about one-tenth the time required formerly.

The grass and weed trimming attachment on the machine makes it highly useful for use in park and playground maintenance. It is especially fast in trimming weeds and grass next to walls and fences, for clearing high grass and brush under portable bleachers and stands in the parks, and for clearing around headstones in cemeteries where it is impossible to operate self-propelled equipment.

● **CLEARING brush along a roadside with the Rowco Brushking. This machine works well in tight corners, and with an attachment, makes quick work of weeds.**

Virginia-D.C. Chapter Holds Meeting in Alexandria

The Spring Meeting of the Virginia-D.C. Chapter of the APWA was held in Alexandria, Virginia on April 13, 1957. The program began with a luncheon. Chapter President J. D. Wright, Director of Public Works of Lynchburg presided. The afternoon session included a talk by A. Howe Todd of Richmond on "The City Planning Commission's Role in the Orderly Growth and Development of a Municipality." This was followed by another interesting talk titled "Sewage Collection and Treatment," by J. J. Corbalis of Alexandria.

The members and guests in attendance then boarded a bus, furnished through the courtesy of the Paving Supply and Equipment Company, and toured Alexandria's Incinerator and Sewage Treatment Plant. The Southern Pipe Tool Company was host at a reception. This preceded the dinner which featured a talk on, "The Operation of the Federal-Aid Highway Program" by A. C. Clark, Assistant Commissioner of the U. S. Bureau of Public Roads.

Chicago Members Hear Talk on Regional Port Authority

Maxim M. Cohen, General Manager of the Chicago Regional Port Authority was the guest speaker at a luncheon meeting of the Chicago Metropolitan Chapter on Thursday, April 4, 1957. A total of 118 members and guests were in attendance. Chapter President Al Konefes presided at the meeting which was held at the Windermere Hotel.

New M-B Packers carry more payload on shorter "CA" trucks!

• Repeat orders from enthusiastic users everywhere prove that M-B Packers are the finest garbage and refuse collection units — fastest on the route and lowest in initial cost and maintenance. Now M-B offers even greater benefits — improved body design, advanced mechanical features and greater hauling capacity on smaller trucks. High tensile steel is used advantageously for greater body strength with less deadweight. New body dimensions now permit mounting on shorter wheelbase trucks with no loss of carrying capacity. These advancements, *plus* superior job-proved features, make the M-B Packer Body a better buy than ever before!

Haul Less Deadweight . . . More Payload!					
Rated Body Capacity (Cu. Yds.)	12	14	16	20	24
Total Inside Capacity	14.1	16.3	18.4	22	26.3
Approx. Body Weight (Pounds)	5100	5500	6000	6500	7500
Minimum Chassis (G.V.W.)	14,000	16,000	18,000	22,000	26,000
Minimum Cab-to-Axle Dimension	84"	84"	102"	120"	152"

New! FULLY ENCLOSED CLUTCH AND DRIVE

Quieter operation — clutch and drive run in oil for long, trouble-free life. Powerful electric clutch provides most effective *controlled packing.*

New! SIMPLIFIED CABLE ARRANGEMENT

Now has two bottom cables only. Actually increases cable life — reduces maintenance and provides more effective packing with stabilized packer plate. No complicated, costly hydraulic system.

New! BIGGER SIDE LOADING DOORS

Larger loading area for easier dumping of big cans, bulky boxes — odd-sized material.

ASK FOR A DEMONSTRATION!

Call your M-B Packer distributor now for an eye-opening demonstration. See for yourself how the newly-improved M-B Packer Body will save time and money on your routes!

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MANUFACTURERS OF QUALITY MUNICIPAL AND CONSTRUCTION EQUIPMENT SINCE 1907

M-B CORPORATION NEW HOLSTEIN WIS

PACKER BODIES LINE MARKERS SWEEPERS TRUCK LOADERS

Mr. Cohen described the progress that has been made toward establishing Chicago as one of the greatest inland ports in the country. He explained how the widening of the 16 mile Calumet-Sag, which connects Lake Michigan with the Mississippi River, will effect the development of the Port facilities that are now being built on Lake Calumet.

Shallow Pools for Playgrounds

Cincinnati had 45 shallow playground pools in operation during the 1956 summer. Water depth ranged from 9 ins. to 42 ins.

Village-Town Merger Brings Economies

RICHARD F. CAHILL,
Town Manager, Northfield, Vt.

THE Selectmen of the Town of Northfield, Vermont, and the Trustees of the Village of Northfield held a joint meeting called by the Town Manager in July, 1956. At that time a decision was made to combine the village and town street departments into a separate department with one man acting as Superintendent. This method was tried for a two-month period and the results were so satisfactory that both the town and village fathers made a joint resolution to operate as a consolidated unit thenceforth. Advantages of the consolidation movement are:

1. A small financial savings.
2. More centralized control for the Municipal Manager.
3. Effective pooling of Town and Village equipment and labor.
4. Better coordination in planning.
5. Better channel of communications.

As of this writing, the consolidated plan has been in effect for nine months. Residents of both the town and the village of Northfield have commented on the snow removal and maintenance work this past winter. Their comment states that roads were plowed in almost half the time it had taken previous to the consolidation of the Street Department.

The result of consolidated Street Department is helping to pave the way for the proposed consolidation of the Town and Village governments into one unit with a special charter for the Town Manager form of government. As of this writing, the proposed charter is in the hands of the 1957 General Assembly of the Vermont State legislature where, if approved, it will be drafted into the form of an act granted to the Town of Northfield. The proposed charter is a 16-page booklet which clearly enumerates the powers and duties of each town official and each department of the municipality.

It may be well to mention that Northfield village now owns its own electric and water department. In the event the town and village vote to merge at their annual meetings in 1959, the two utilities will be owned by the Town of Northfield. Advantages of consolidation will be an annual savings of $2,000 to $3,000; more effective and efficient government; centralization of materials and supplies; and finally, equal distribution of muncipal services such as police and fire protection, water, sewer, sidewalk and electric services to the residents in the outlying area called, "The Town."

A fire fighting training school has been started in Northfield for the members of the local fire department, civil defense members and members of volunteer fire depart-

Bucket teeth and ripper available at extra cost.

TEETH AT BOTH ENDS* BOOST PRODUCTION!

Production really steps up when this working team moves in—the Allis-Chalmers HD-6G tractor shovel with replaceable bucket teeth and rear-mounted ripper. Here's a job-proved combination engineered by the company that pioneered modern tractor shovels for the construction industry.

When the hydraulically controlled ripper bites in, even hard blacktop has to give. With the help of teeth at the front end, too, tough material is loosened and broken up for fast, easy loading—a full bucket every time.

You get more work done in less time because the heavy-duty HD-6G is designed for tough jobs. With 72 net engine hp and six-truck-wheel stability, it offers performance that means efficient production every hour on the job.

These important advantages are also available on bigger Allis-Chalmers tractor shovels—the 2½-yd HD-11G, the 3-yd HD-16G, and the 4-yd HD-21G . . . to help you meet the needs of your tractor shovel jobs. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*

ments from neighboring communities. The fire fighting training school is a 15-week school sponsored by the Vermont Fire Fighter's Association. The school is conducted at no cost to the municipalities. Upon completion of the 15-week school, a fireman is trained and equipped in all phases of fire fighting.

At the present time plans are being made to construct approximately 0.4 mile of road in the village of Northfield with bituminous concrete. The job is a Federal Aid Primary Job, whereas the Federal Government pays 50 percent of the construction cost, while the State and local governments each pay 25 percent. The total cost is in the vicinity of $155,000; 25 percent of this amount has been raised, pledged and assigned by the Village of Northfield. Plans call for two 12-ft. lanes for moving traffic; two 8-ft. lanes for still traffic, and two 5-ft. sidewalks. Included along with this construction job is the widening of a concrete bridge; installation of mercury vapor lighting; and the building of 0.2 mile of sanitary sewer.

• • •

Population Projections

(Continued from page 111)

tend to stay in fixed relationship or change very slowly over time. Consequently, for short-term forecasts, we can assume that the recent ratios will prevail. For long-term projections, however, assumptions of constant ratios may not be logical. For 25 years or more, it may be well to assume that the difference between local and national vital rates will tend to disappear with time, and hence that the ratios will converge toward unity at some distant future date, say in 50 years or so. For example, if in 1950 the local rate was found to be ten percent less than the national average (a ratio of .90), we could assume that by the year 2000 this difference would disappear. The ratio would be increased by approximately .02 each 5 years, reaching .95 by 1975 and 1.00 by the year 2000. These projected ratios could then be applied to the United States rates implied in the latest U. S. Census Bureau reports on national population projections to obtain area crude birth and death rates for later years.[3] Because of the uncertainties involved in predicting future fertility, projections at the national level will normally include alternate series.

Developing estimates of net migration for future years for local

Spraying or dusting. The Universal 'Jeep'* is an all-purpose workhorse. It tows almost any type of spraying or dusting equipment for mosquito or weed control work in parks or other wooded areas. With optional 4-speed transmission, it's unequalled where slower-than-ordinary speeds are essential. The extra traction of its 4-wheel drive keeps work moving 365 days a year.

Only 4-Wheel-Drive 'Jeep' vehicles do so many jobs so well!

Mobile power. The Universal 'Jeep' with power take-off operates air compressors, mobile welders, generators, winches and many other types of equipment. And 'Jeep' mobility saves travel time between jobs.

The 'Jeep' Utility Wagon. With its ruggedness, stamina and "go-anywhere" dependability the 4-Wheel-Drive 'Jeep' Utility Wagon is ideal for many maintenance assignments. It carries up to 110 cubic feet of equipment and supplies or 6 supervisors or workers.

New Forward Control 'Jeep' FC-150. New Forward control design puts a 74-inch pickup box on a wheelbase only 81 inches long. With its "go-anywhere" maneuverability, 200% greater forward visibility, and 4-wheel drive traction, it takes men and equipment almost anywhere.

**Model CJ-5 shown.*

Economy-minded officials everywhere are turning more and more to the 'Jeep' family of 4-Wheel-Drive vehicles to help get work done faster at lower cost. And no wonder! Their cost-cutting performances on an endless variety of jobs are matched with long life and low upkeep. And the extra traction of their 4-wheel drive takes them where other vehicles can't go. They shift easily into conventional 2-wheel drive for normal highway travel. Their "go-anywhere" dependability is extra insurance in public emergencies. See your nearest Willys dealer for a demonstration today.

The 'Jeep'®
family of 4-Wheel-Drive vehicles

WILLYS...manufacturers of time-tested utility vehicles

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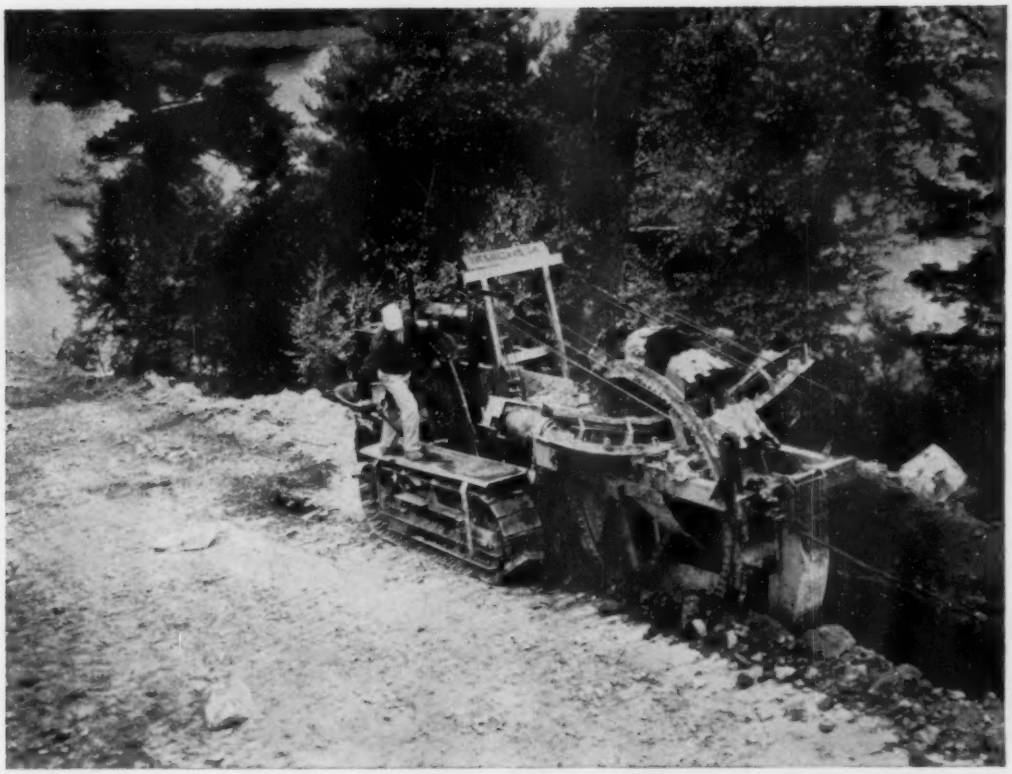
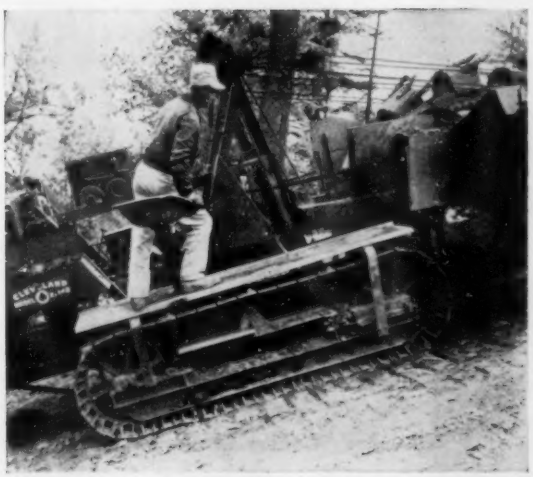
areas is considerably more hazardous than the preparation of estimates of future natural increase. National guides are not available and information on the effect of factors likely to influence migration, such as changes in economic opportunities, is also usually lacking. Here, too, it may be necessary to lean heavily on past trends as a guide to the future. Local planners and estimators, however, may be in a position to incorporate into the assumptions of future migration, significant local developments now underway or in the planning stages which may sharply affect the rate of population growth in their area. It is quite possible, for example, that areas of historical out-migration may radically change such patterns as a result of promotion and expansion of their commercial and industrial facilities. Knowledge of the interrelations between demographic developments, on the one hand, and developments in social, economic, and technological fields on the other, is still imperfect, so that it is a complex task to estimate future population growth from projected economic goals.

Direct information on migration to or from an area for past periods is not always available. Some estimates of migration for 10-year intercensal periods can be developed by a "residual" procedure using census data and appropriate vital statistics. Thus, estimates of net migration for the 1940-1950 period for geographic areas can be obtained by subtracting from the net population change between the two census dates an estimate of the excess of births over deaths during the period. Other indications of past trends in migration can be obtained from the 1940 and 1950 Censuses, which furnish data for the 1935-1940 period (States only) and the 1949-1950 period (States and State economic areas) on the basis of questions regarding place of residence in 1935 and 1949, respectively. Estimates for other periods such as for 1920-1930 and 1930-1940 can be prepared by the "residual" procedure just referred to.

Discussions of methods of estimating net migration using census data are given in: United States Bureau of the Census, *Handbook of Statistical Methods for Demographers*, by A. J. Jaffe, Washington, D. C., U. S. Government Printing Office, 1951. Estimates for 1940-1950 for counties, cities, and standard metropolitan areas, in many instances have already been prepared and published by Agricultural Experimental Stations attached to State universities.



Cleveland 140 digs through rocky New Hampshire hills



"...exceeds wildest expectations"

"We got trench with our Clevelands where we thought it would be impossible," says H. J. Burns of Hallen Construction Co., Island Park, N. Y., about a recently completed pipeline job for the Granite State Transmission Co., between Exeter and Somersworth in the rugged New Hampshire hills. The Hallen spread cut through numerous swamps and terrain strewn with boulders and choked with frequent outcroppings of rock.

"Our Cleveland 140 cut 24 miles of our 30-mile section—dug everything except the deepest swamps and solid ledge rock. It dug through shale and even handled boulders up to 6 and 8 cubic feet. Even in the toughest going the 140 never fell below 1,700 feet of trench per day and averaged 2,200 feet per day for the whole job."

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In addition to these intercensal estimates of net migration, it may be necessary to develop estimates for the more recent period since the last census. As indicated earlier, direct information is not available and it will be necessary to use various symptomatic data to measure current migration. In fact, it may generally be necessary to prepare a reliable "current" estimate of the population of the area in question to use as a base point for the projections. An estimate of net migration can be obtained as a by-product. A current population estimate is needed particularly where a number of years have elapsed since the last census and many significant population shifts may have occurred. Several methods have been developed for making current estimates and one of them, the "component Method II" used by the Census Bureau in preparing its estimates of State population, involves developing separate estimates of net migration for the period since the last census. Space does not permit a detailed discussion of procedures for preparing current estimates. Various Census Bureau reports, and articles by statisticians working in the field of population estimation, contain detailed descriptions of the best methods now in use[4]. One Census Bureau report, *Current Population Reports*, Series P-25, No. 133, gives an illustrative example of the procedures used by the Bureau in preparing estimates of State population.

An evaluation of the recent trends in migration for the area should afford some insight for the future. It should be emphasized, however, that an assumption of a continuation of such trends for later years is not necessarily the best approach. As implied earlier, changes in general economic conditions (both national and local) may entirely reverse recent past trends. Here, of course, the local statisticians, with a knowledge of the factors which may affect population growth in the area, are in a strategic position to bring this knowledge to bear when developing the migration assumptions underlying the projections.

Population projections for future dates by the simplified component method are obtained by adding to the latest estimate of the total population (or to the 1950 Census, if estimates for more recent dates were not obtained) projections of each of the components for future years developed as outlined above.

The application of this version of the component method of projecting population is illustrated in the Census Bureau report, *Current Population Reports*, Series P-25, No. 110, presenting projections of State population for 1960 and 1965 (No. 13 in Appendix). In that report, three different assumptions were made regarding future net interstate migration. Each series assumed that the average annual net migration of some previous period would prevail throughout the projection period (1953 to 1965). The base periods selected for this purpose were 1940-1953, 1930-1953, and 1940-1950. For future natural increase, the projections assumed that the ratio between State and U. S. birth and death rates would remain constant to 1965. The constant ratio assumed was the average ratio for the 1950-1953 period.

Cohort-Survival Method

The more detailed "cohort-survival" method is also essentially a component approach but the computations are carried out age by age. This procedure involves carrying forward the population, by age, as shown by the last population census (or by the most recent age estimates) on the basis of assumptions regarding future deaths, births and

NEW MEXICO proves OVERLAID FIR PLYWOOD SIGNS best by test

Plagued by vandals—who took an annual toll of over $25,000—and damage from severe weathering, the State of New Mexico Highway Department five years ago began a series of laboratory and field tests to develop signs which would effectively lower maintenance and replacement costs.

As a result, the department reports overlaid plywood the most durable of all sign materials. The state is now using it to replace steel and aluminum for signs in areas where vandalism had been prevalent. To date over 44,000 overlaid plywood signs have been placed in service. In all cases, they have lived up to expectations.

The Highway Department also cites superior paintability, ease of fabrication and elimination of framing or backing in larger signs as additional points in favor of overlaid plywood signs.

OVERLAID FIR PLYWOOD* GIVES YOU THESE ADVANTAGES

- Combines strength, rigidity and workability of plywood with smooth, durable, fused resin-fiber surfaces.
- Great resistance to severe weathering . . . accidents . . . gunshot, bending, other acts of vandalism. No progressive deterioration after damage. Cannot rust or corrode.
- Perfect for long-lasting paint or silk screen finishes. Reflective sheeting may be applied direct to high density overlay, eliminating prime coat.

*OVERLAID PLYWOOD is top-quality DFPA quality-tested Exterior fir plywood (EXT-DFPA®) with durable fused resin-fiber surfaces. Two types: (1) High density overlay is hard, glossy... need not be finished; (2) Medium density (paint grade) is smooth, opaque.

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Firm or Dept. _____

Address _____

City _____ Zone ____ State _____

net migration, each of these being treated on an "age-specific" basis. For example, to obtain an estimate of the population 15 to 19 years old in 1960, we would subtract from the population 5 to 9 years old in 1950 an estimate of deaths in the group during the next ten years and, add or subtract, as the case may be, an estimate of the number of persons in this group moving into or out of the area.

Developing estimates of the number of persons that are likely to die during the projection period, age by age, does not present any major problems. The use of the latest United States life tables or the 1949-51 state life tables to estimate the number of deaths will generally be acceptable. This procedure, of course, assumes that death rates will remain at current levels. It might be pointed out that the prospects for further declines in mortality are good and such declines may have a significant effect on population growth in an area. In view of the uncertainties in estimating the other components of change, however, mortality is the most logical choice for "short-cuts" and simplified procedures. An exception would be projections of the populations in the older ages. Here, mortality is high and often plays a substantially greater role in determining the future levels of population than does migration. In such instances, modifications in the age-specific mortality assumptions would be important.

Projections of births could be derived in the same manner as described above for the simpler component approach.

Estimates of net migration, by age, for past periods, for use with the cohort-survival technique should be developed by essentially the same procedures outlined above, but working with age detail. The estimate of migrants can be prepared in terms of rates or absolute numbers. Generally speaking, it may be simpler to work with absolute values rather than with rates.

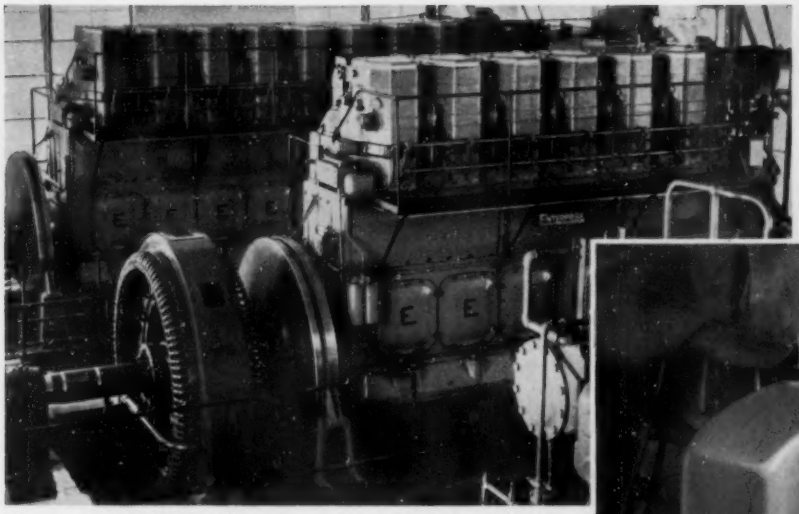
The detailed cohort-survival procedure is also illustrated in some of the reports cited in the Appendix.

The component procedures just discussed are relatively simple in conception but somewhat difficult operationally. Aside from the normal difficulties of developing adequate data on past trends in natural increase and net migration, there is the problem of describing the future course of migration. An early method used by estimators to by-pass the problem of projecting future migration was to use the component procedures to produce population projections which assume no further net in- or out-migration for the area. Such projections by themselves are admittedly unrealistic, but additional projections can be prepared showing the effect on population growth assuming various levels of net migration. Thus, for example, we might assume that migration would continue at the same levels as at some recent periods; or at twice or even at one-half the average of recent levels. In this way, the planner can decide which assumptions are most appropriate for his needs. In planning for adequate future water supply, for example, it would appear that one would prefer population projections on the "high" side and thus would incorporate in-migration levels somewhat higher than one whose needs may be best served by "medium" or "low" projections.

Ratio Method

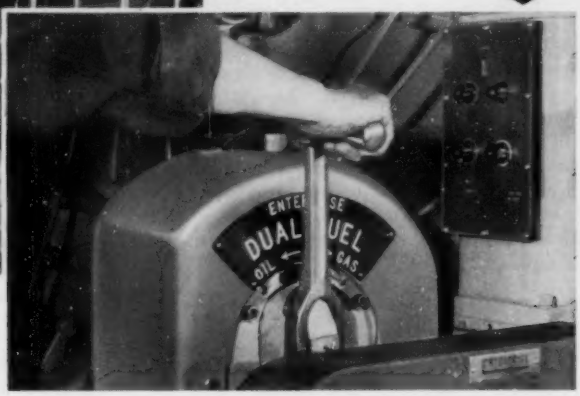
Another commonly used procedure that appears to have wide acceptance is the one usually referred to as the "ratio" method. Essentially, this technique involves projecting the population on the basis of past trends in the area's share of a larger population, such as the United States, which has already been projected. Briefly, the method consists of (1) extrapolating the ratio of a) the population of the area for which a projection is required to b) the population of a larger area which includes the first area and for which acceptable population projections are already available; and (2) applying the extrapolated ratios to the population projections for the larger area to obtain projections for the smaller area. In most instances, satisfactory population projections may not be available for areas other than for the nation as a whole and the ratios will be expressed in terms of the area's population in relation to the population of the United States. The ratio should be developed for a number of past dates, say, for example, 1920 to 1950, in order to have a firm basis for extrapolating the ratio to future dates.

There are a number of ways of projecting the ratios. One could assume, for example, the continuation of recent changes in the ratios based on simple arithmetic or even geometric extrapolation of the ratios in the most recent period. In one recent report by the Census Bureau in which the ratio method was used to develop State projections (Series P-25, No. 110, mentioned above)



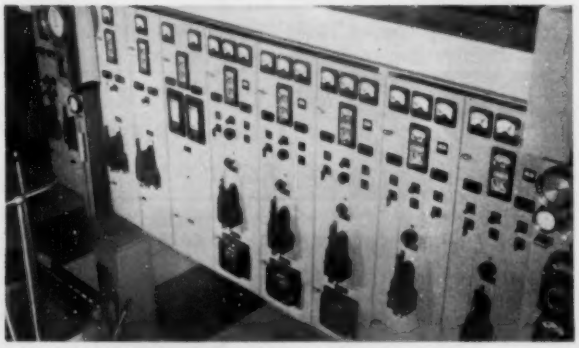
The two Enterprise Diesels were equipped for "Select-O-Matic" Dual Fuel operation in the field after installation, taking full advantage of low-cost gas for fuel.

A single lever simplifies fuel selection. After manual setting, any fluctuation in gas pressure is compensated for automatically, thereby maintaining constant engine speed and load.



City of Broken Bow, Nebraska, Switches to Enterprise Dual Fuel—Saves $36,000 a Year!

Broken Bow's model municipal utility plant is under the capable supervision of L. E. Clark. *"These Enterprise Engines have given us exceptional performance in every way,"* says Clark, *"we're more than satisfied with their excellent record."*



Modern control panel keeps tab on plant production. A unique "Metered Maintenance" plan developed by Mr. Clark keeps operating and maintenance costs at a minimum.

Electricity comes cheap at Broken Bow, Nebraska, where two Enterprise "Select-O-Matic"® Dual Fuel Engines, running on natural gas with pilot oil, have cut $100 a day in fuel costs since their installation three years ago. Because of their low cost operation, they have virtually replaced the three original engines, which are now used for standby and peak load service only.

Intercooling boosts output. Even though Broken Bow's summer and winter temperatures vary greatly, the Enterprise Engines, through Intercooling, run at full load with no increase in temperatures or pressures. The result is greater KW output and economy.

The real payoff has been in greatly reduced electric rates, and a modern, dependable power plant that has paid for itself and is contributing to the general improvement fund.

Get full information on Enterprise Engines today. Units from 73 to 7703 HP in Diesel, Dual Fuel, Tri-Fuel, Spark Ignited Gas—for every stationary, municipal, and marine use.

Over a million horsepower at work the world over!

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future average annual rates of change in the ratio were determined on the basis of the consistency of the direction of change as shown by the ratios for the past three decades (1920 to 1950). In areas where the direction of change was consistent from decade to decade, the rate of change in the ratio for the first year was assumed to be the same as the rate for the period which was least in absolute value (closest to zero). It was further assumed that the annual rate of change in the ratio would decrease linearly to zero in fifty years, i.e., the ratios would be fixed at the end of that period. The average annual rate of change in the ratio is determined algebraically from the "compound-interest" formula, as follows:

$$(1 + r)^n = \frac{R_1}{R_o}$$

Where r = average annual rate of change in ratio
n = number of years in the base period
R_1 = ratio of area population to the U. S. population at end of base period
R_o = ratio of area population to the U. S. population at the beginning of the base period

Generally, it would require successive multiplication to arrive at the ratio for any particular date, and where a number of areas are involved, the computational work can be substantial. Some short-cut procedures have been developed for this method which cut down considerably the actual computations.

These procedures are described in "Short-Cuts in Computing Ratio Projections of the Population," by Helen R. White, Jacob S. Siegel, and Beatrice M. Rosen, *Agricultural Economics Research*, Vol. V, No. 1, January 1953.

The ratio method is fairly mechanical and, like most other methods of population projection, assumes that past trends provide the most satisfactory guide to estimating future growth. It is logical in that it recognizes the interdependence of population changes throughout the country (This may be somewhat less important when dealing primarily with a single area). As described here, the method tends to be conservative in the sense that, although it assumes a continuation of past changes in ratios, it allows for a slowing up of the processes of population redistribution. The method is simple to adapt and probably most useful for long-range forecasting where component or other direct approaches are impractical. A more detailed description of the method and additional illustrations of applications are given in some of the reports shown in the Appendix (Nos. 5 and 13).

Other Methods

There are several other methods which may be quite useful in particular circumstances. For forecasting city population, "holding capacity" may form the basis of determining probable future growth. This concept involves consideration of such items as zoning regulations, vacant land and dwellings available for future use, urban redevelopment, etc. In fact, in developing the master plan many cities may attempt to set their maximum desirable population densities and then may seek to achieve their presumed optimum population by the implementation of planning and zoning regulations.

Other procedures which hold promise are those that take into account the economic prospects of an area. A technique used quite often is one that assumes a fixed relationship between population and employment in an area. The main problem here, of course, is to provide adequate forecasts of employment. The methods for forecasting employment are as varied and as spec-

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ulative as those for making population projections.

See, for example, F. Stuart Chapin, Jr., "Employment Forecasts for City Planning," *Journal of the American Institute of Planners*, Vol. XX, No. 2, Spring 1954.

Methods using economic analyses as part of a comprehensive undertaking preparatory to making population projections appear to offer, at least *a priori*, the most logical (and perhaps promising) approach to the problem of determining future population growth and distribution. Unfortunately, such procedures generally require forecasts of a variety of economic components which may merely compound the difficulties. A good example of the "economic base" approach to forecasting is the Mass Transportation Study for the D. C. metropolitan area.[5]

The methods outlined here do not by any means represent the whole range of possible procedures; nor are they the only advisable procedures to use. Also, the use of any of these does not guarantee realistic or accurate results; and very little evidence exists that demonstrates the superiority of one method over the others.

Selected references indicating some of the more recent efforts in this field are listed as an Appendix to this article. These reports contain forecasts for a number of specific geographic areas and illustrate the use of a variety of procedures, including those described here. Some of the reports may prove useful to persons needing illustrative projections for some areas.

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5. *Economic Base Study for the General Development Plan, National Capital Region* (prepared for the National Capital Planning Commission and the National Capital Regional Planning Council), Council for Economic and Industry Research, Inc., Washington, D. C., June 30, 1956.

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vandalism tests

One of the first really definitive jobs of determining relative "vandal and abuse" resistance of standard highway sign materials was completed recently by the Douglas Fir Plywood Association Research and Engineering Department.

The results (see table) may prove something of an eye opener to anyone who assumed metal signs are stronger or more durable than overlaid plywood —or even ordinary Exterior plywood.

Actually, the tests show overlaid plywood has considerably more stamina, and maintains better message legibility after damage than either steel or aluminum. Glass fiber signs, apparently, just aren't in it when it comes to shrugging off abuse.

MATERIAL / TEST	OVERLAID PLYWOOD[1]	ALUMINUM[2]	STEEL[3]	GLASS-FIBER[4]
Flying objects	Fair	Fair	Fair	Fair
Knockdown	Good	Fair	Bad	Poor
Gunfire	Good	Poor	Bad	Fair
Bending (Machine)	Good	Fair	Good	Bad
Racking (Hand)	Good	Good	Very Poor	Very Poor
Average Rating	Good	Fair	Poor	Poor

1. OVERLAID PLYWOOD (both medium and high density) ⅝" thick, 5-ply. Weight: 7 lbs.
2. ALUMINUM—6061-T6 type .081" thick. Weight: 5 lbs.
3. STEEL—16 gauge bonderized. Weight: 11 lbs.
4. GLASS FIBER—resin bonded glass fiber approx. .0145" thick. Weight: 5 lbs.

The 24" square signs tested (steel, aluminum, glass fiber and overlaid plywood) were subjected to abuse under carefully controlled conditions. All (except glass fiber which was factory finished) were given recommended finishes with reflective sheeting on one face.

Tests included flying objects, gunfire, knockdown and bending. Ratings are based on extent of damage and legibility loss immediately after test; prolonged exposure would, of course, further impair legibility—particularly in the case of steel which rusts after protective coating is broken.

If you'd like a copy of the complete report (it's a 32-pager, complete with detailed procedures and photos) simply mail coupon.

no prime coat needed

One of the biggest advantages of PlyGlaze (high density overlay) is the fact that it requires no protective paint coating. Nor is any prime coat needed before applying reflective sheeting. The hard, plastic-like PlyGlaze surface provides an ideal base for permanent, weatherproof bonding. It will not check, blister or deteriorate when marred by bullet holes.

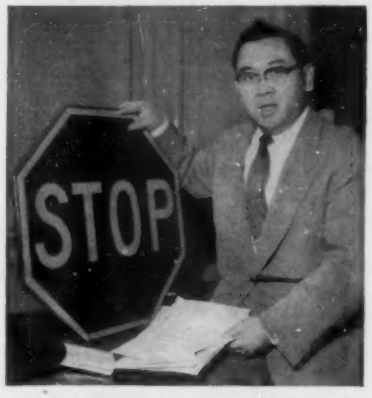
PlyAloy (medium density overlay) panels are recommended for non-reflectorized signs. If reflective sheeting is used, panel should be given prime coat.

case history

The City of Tacoma (Wash.) has sharply reduced costs by switching to PlyGlaze traffic control and regulatory signs. Of the city's almost 8,000 signs, 7,380 are PlyGlaze, and the others are being replaced as they are damaged. About 60% are reflectorized.

According to Yosh Kosai, city traffic engineer, the PlyGlaze signs have two important advantages: 1. *Cost;* based on current standards and specifications, PlyGlaze signs are less expensive than metal. 2. *Durability;* PlyGlaze signs last longer. Vandals can't wrap them around posts, nor do they chip or rust when struck by rocks or bullets.

The changeover was initiated by R. E. Schmidt, Kosai's predecessor. The first PlyGlaze signs were installed in 1951. After 6 years appearance and legibility remain excellent. The only significant damage has been from knock-down and



even though the posts had to be replaced, the signs themselves have remained in service.

description, specifications

PLYGLAZE:* Exterior plywood with high-density phenolic resin-fiber overlay fused to both sides of panel. Overlay is hard, glossy, abrasion resistant. Ideal base for reflective sheeting. Colors: buff, black.

Specification: PlyGlaze (B-B) 60/60 High Density Overlaid fir plywood, manufactured by St. Paul & Tacoma Lumber Co.

PLYALOY:* Exterior plywood with smooth, durable medium-density overlay on one or both faces. Overlay is ideal paint base; has texture similar to expensive drawing paper. Color: buff.

Specification: PlyAloy Medium Density Overlaid fir plywood, faced both sides (F2S) . . . or faced one side (F1S) . . . manufactured by St. Paul & Tacoma Lumber Co.

*Both PlyGlaze and PlyAloy meet U.S. Commercial standards, are DFPA-Inspected. Available in standard plywood sizes, thicknesses.

FOR MORE INFORMATION (detailed specifications, application data, etc.), **please mail coupon**

ST. PAUL & TACOMA LUMBER CO. TREE LIFE FOREST PRODUCTS ESTABLISHED 1889

St. Paul & Tacoma Lumber Co., Dept. PW, Tacoma 1, Wash.

Send literature and/or material checked:

- ☐ Specification & Application Data
- ☐ Samples and Current Prices
- ☐ Complete Vandalism Report

Name_____

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Address_____

City_____ Zone____ State_____

PUBLIC WORKS DIGESTS

THE WATER WORKS DIGEST

Fundamentals of Well Design

Particle sizes and arrangement in a geologic formation are subject to variation, but sands and gravels do occur as rounded particles that stratify in size ranges. Within a particular formation, however, the forces of deposition seldom have been uniform, so that permeability within an aquifer varies. Location of the most permeable area is the object of test drilling. It is desirable to have several test wells at various distances around the well to be pumped and water level measurements are made on all observation points. From these data and the pumping rate, the coefficients of transmissibility and storage are computed. Drawdown values obtained for the pumping well by straight application of the Theis formulas represent only the head losses suffered by water movement through the formation under laminar flow conditions. The actual pumping level of a well cannot be calculated without additional considerations. The water works operator should keep test well records including logs and pumping data, be aware of daily pumpage, make a record of water level measurements regularly. These records often will permit evaluation of the condition of existing wells and the aquifer and make corrective measures possible when needed.

"Design and Rating of Wells and Well Fields." By L. M. Miller, Michigan State Dept. of Conservation. *Jour., A. W. W. Ass'n.*, April.

Imperial Valley Water Plant

Faced with damage suits, arising because of seepage from earthen storage reservoirs, the City of El Centro employed engineering consultants and modernized its water supply system, abandoning the earthen reservoirs and slow sand filter treatment plant. Unusual problems of design included the high water consumption for lawn sprinkling and air conditioning and the low turbidity and slime growth in the raw water. Treatment employed consisted of an Accelator, rapid sand filters, with backwash recovery, and chlorination. Raw water storage basins, 70-mg capacity, were constructed 16 ft. deep, with 11 ft. of the side water depth above ground; asphaltic concrete was used as a lining material. Provisions were made for periodic washing down and pumping out. Washwater troughs in the filters are constructed of prestressed fiber glass. Another unique feature is including filter gauges in a centralized control panel. Telemetering and an alarm system effect almost completely automatic operation. Filter backwashing is done manually whenever the control panel signals the preset head loss. Coagulation is effected by ferric sulfate with powdered limestone as a coagulant aid.

"Automatic Treatment Plant and Ample Storage Solve El Centro Water Problems." By J. F. Golden, Golden, Bryant and Jehle, Architects and Engineers. PUBLIC WORKS, May.

Filter Operation Controlled without Valves

A rapid sand filter has been designed by the Permutit Co. which utilizes head differentials to control the normally manual operations—taking a filter out of service, backwashing it, and returning it to service. A feature is a backwash storage chamber as a part of the filter shell. As loss of head through the filter builds up, levels rise in the influent line and in a pipe column connecting the top of the filter to the waste line. This creates a siphon action which draws water from an upper storage chamber into the underdrain system for backwashing. When the water level in the storage chamber drops below a siphon breaker, air enters the pipe column, stopping the backwashing. Since the influent line and the backwash storage chamber are interconnected through the filter and effluent chamber, the backwash storage chamber automatically fills as loss of head increases, readying the filter for the next backwash operation. Valves or other controls and wash water pumps are unnecessary. The filtering rate is 3 gpm per sq. ft.; the backwash rate, 15 gpm per sq. ft. average. Advantages are automatic operation; overruns are eliminated; there is no danger of wash water waste; and there are savings in initial construction costs. Another factor which may be an advantage is an elevated effluent line, 14 ft. above the floor level in the case of the 10-ft. diameter unit.

"Automatic Gravity Filter Operates Without Valves." PUBLIC WORKS, May.

Industrial Cooling Water Affects Water Resources

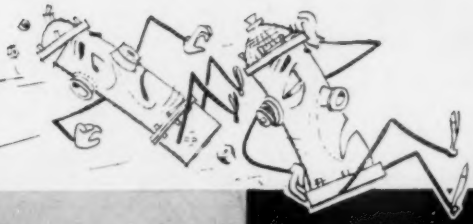
When waters are warmed as through the discharge of waste cooling water in power production, the processes responsible for modifying water quality that are changed are: The rates of decomposition of organic matter through variations in life cycles of microorganisms are increased; pathogenic organisms survive for shorter periods of time; the activity of disinfectants increases, but the rate of chlorine demand also increases; a high proportion of blue green algae is supported; the density and viscosity decline, permitting more rapid settling and filtration; alum flocculation and precipitation may be more efficient. In general it does not appear that waste heat dissipation into water sources creates any problems that cannot be solved by existing methods. Coal-burning power plants produce some industrial type wastes which may add phenolic type materials to water or increase concentrations of certain minerals. The growth of the industrial community will impose more exacting requirements for technical resourcefulness and alertness.

"Warm-Water Effects on Municipal Supplies." By C. E. Renn, Johns Hopkins U. *Jour., A. W. W. Ass'n.*, April.

Basic Principles of

ly in expression of laboratory re- a rough guide. Coagulant selection

OUT THEY GO!



and IN go EDDY HYDRANTS

Many of the 650 fire hydrants in Maywood, Illinois (pop. 30,000), have been in service 40 years or longer. Some were no longer being manufactured, and repair parts were unavailable. In a decision to modernize its hydrants, Maywood decided to standardize on Eddy hydrants in 1954—to simplify servicing, cut maintenance costs, reduce parts inventory, and assure service for the future.

Eddy hydrants had proved highly satisfactory in Maywood's 50-mile system, and repair parts have always been available. Under the aggressive direction of public works director Bazel E. Crowe, above left, the replacement program, has proceeded at a fast, economical rate, with more than 170 hydrants replaced in 1956 alone.

it's the safest, most economical course!

Maywood feels that it cannot risk hydrant failure, nor afford the sky-high cost of handmaking individual repair parts for obsolete, "orphan" fire hydrants. Can you?

Based on the experience of this and other alert communities, your city or village might do well to take stock of its hydrant situation. If so, an EDDY man will be very glad to give facts and figures you will find most helpful in making a wise decision. Won't you invite him to see you . . . soon?

AWWA EDDY BRONZE-MOUNTED HYDRANTS

EDDY Bronze-Mounted HYDRANTS open smoothly with the pressure and close without water hammer. One man can easily remove all operating mechanism for inspection and repair. Positive drip action automatically drains the standpipe, safeguarding against freeze-ups. Stem held in place below hydrant valve means that there is no water loss due to a bent stem.

EDDY AWWA (UNDERGROUND) VALVES

Everything in AWWA valves for underground use in your waterworks system is quickly available from Eddy—gate valves; cutting-in valves and sleeves; tapping valves and sleeves. And, remember, Eddy's more than 100 years' dependable operation is your assurance of service far into the future.

EDDY VALVE COMPANY
A Subsidiary of James B. Clow & Sons, Inc.
WATERFORD NEW YORK

Basic Principles of Water Plant Operation

This text was prepared in the interest of providing a source of basic information and a simplified approach to the study of standard references, and is intended as a companion text to "Water and Sewage Chemistry and Chemicals" published in PUBLIC WORKS in October, 1956. The operator should be familiar with commonly used terms of measurement and methods of conversion. In weight-volume relationships, the expression mg/l is taking the place of ppm, particularly in expression of laboratory results. All surface water treatment plants should be provided with a laboratory to perform tests which will permit control of operation of the plant; these should include, depending on source of supply and type of treatment, turbidity, color, pH, alkalinity, hardness and bacteriological examinations. Somewhat recently developed procedures include the EDTA method of hardness determination and the membrane filter technique of bacteriological analysis. In coagulation practice, chemical dosages are best determined by trial, using jar tests as a rough guide. Coagulant selection depends on factors including pH, alkalinity and turbidity. Coagulant aids are available for producing a more efficient and durable floc. Common filter operating difficulties include the occurrence of mud balls and layers, cracks, clogging, calcium carbonate coating, and shrinking. Free available chlorine is a powerful disinfectant and results from a complete reaction with ammonia or ammonia products and organic matter. Tests are necessary to produce and control a residual which involve trial dosages, and allowances for interfering substances. Safety precautions should be observed in handling chlorine. Fluoridation can be accomplished using sodium fluoride, sodium fluosilicate, hydrofluosilicic acid, and fluorspar. Feeders now commonly employed in adding chemicals are applicable to fluoridation. Algae control involves identification of forms present and judicious use of algacides such as copper sulfate and chlorine. Taste and odor control should be based on routine threshold odor tests. Control procedures available consist of aeration, adsorption with activated carbon, and oxidation by chlorine dioxide or chlorine.

"The Operation of Water Treatment Plants." PUBLIC WORKS, May.

Operation of Water Distribution Systems

The general scope of the term water distribution system is very broad and would normally include distribution mains, valves, hydrants, service connections, meters, booster pumping stations, storage facilities, maintenance shops, etc. This article covers the major items under this classification and particularly in respect to the more important considerations rather than a complete coverage.

"Operation and Maintenance of Water Distribution Systems." By Wallace T. Miller. *Water and Sewage Works*, February.

Tracing Ground Water Pollution

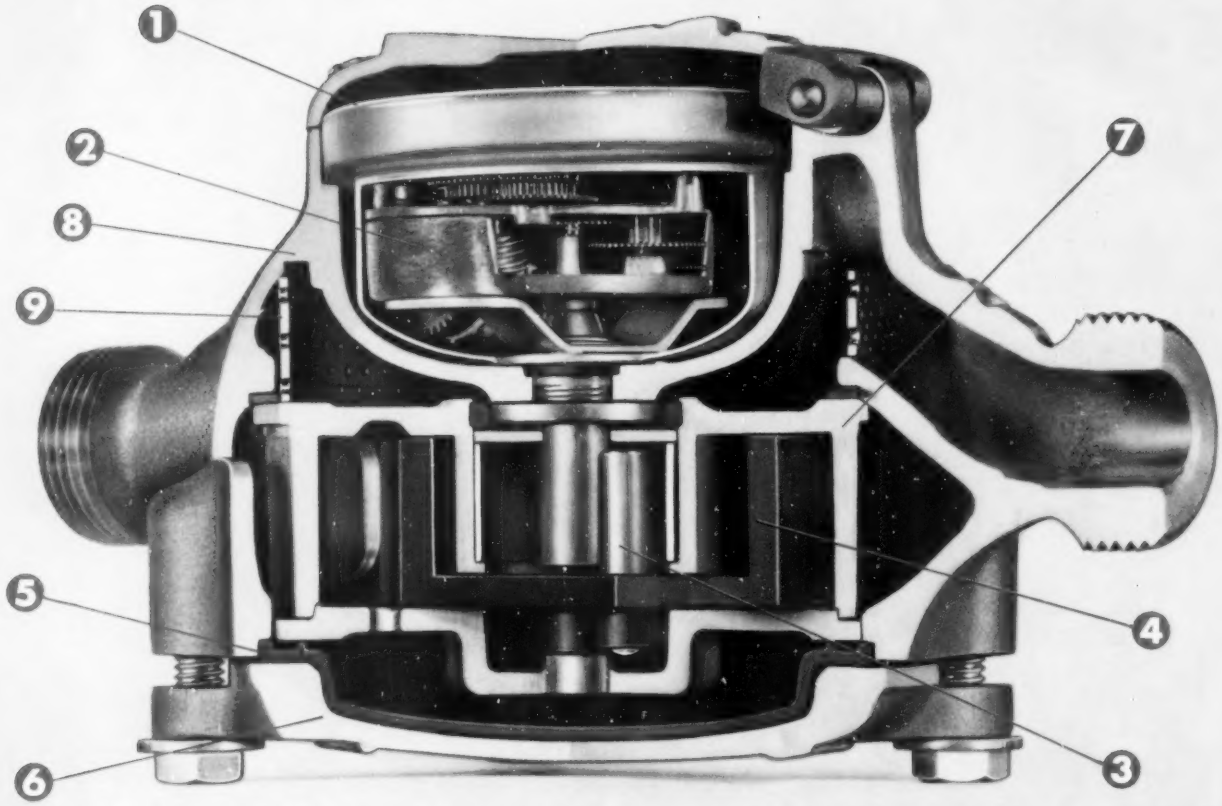
Underground water pollution is of prime importance to public health officials concerned with safeguarding the potability of water supplies. This study was made at an experimental site about 2 miles south of Anchorage where the ground water table was shallow, with the top between 5 and 6 ft. below the surface of the ground. Mechanical analysis of the soil at

(*Continued on page* 163)

The WATER METER OF THE FUTURE Is Here TODAY!

Rockwell Announces

The Most Important Advance In Water Meter History



ROCKWELL SEALED REGISTER WATER METER **with Powerful Magnetic Drive**

Presenting

THE INSIDE STORY OF A REVOLUTIONARY METER DESIGN HAVING ALL THE FEATURES YOU ASKED FOR

1. HEAT TREATED GLASS —stops breakage.
2. HERMETICALLY SEALED REGISTER —to prevent condensation—to keep out water and dirt.
3. MAGNETIC DRIVE —eliminates stuffing box—reduces drag on measuring chamber.
4. OSCILLATING PISTON —time proven for accuracy and durability.
5. "O"-RING GASKET —molded into bottom plate liner—provides positive seal.
6. INTERCHANGEABLE BOTTOM PLATE —bronze or cast iron (for frost protection).
7. MEASURING CHAMBER —mates without screws.
8. CAST BRONZE CASE —with full flow passageways.
9. CYLINDRICAL STRAINER —large area for unrestricted flow.

Quick Facts about the ROCKWELL SEALED REGISTER WATER METER

It's an entirely new water meter, designed and constructed in answer to the expressed needs of the water works industry for better measurement at lower cost.

The principal features are (1) an hermetically sealed register to end forever the problem of dirt, water and condensation that fogs dials, (2) a powerful magnetic drive which eliminates the need for a stuffing box, an exposed intermediate train and a driving dog, (3) the proven oscillating piston principle for a long life of accurate measurement.

This all-new design is cased in an attractive housing that's more compact, easier to handle and install.

FIVE POINTS OF SUPERIORITY

1. GREATER ACCURACY

Straighter line curve—picks up smallest leaks.
No friction from conventional driving dog, gear train, stuffing box and register.
Oscillating piston principle for proven accuracy, sustained long life.

2. ALWAYS EASY TO READ

No fogging, no dirt, no oil, no fading of dials.
Larger dial.
Fewer misreads and bill corrections.
Home-owner can read—fewer complaints.

3. LOWEST MAINTENANCE

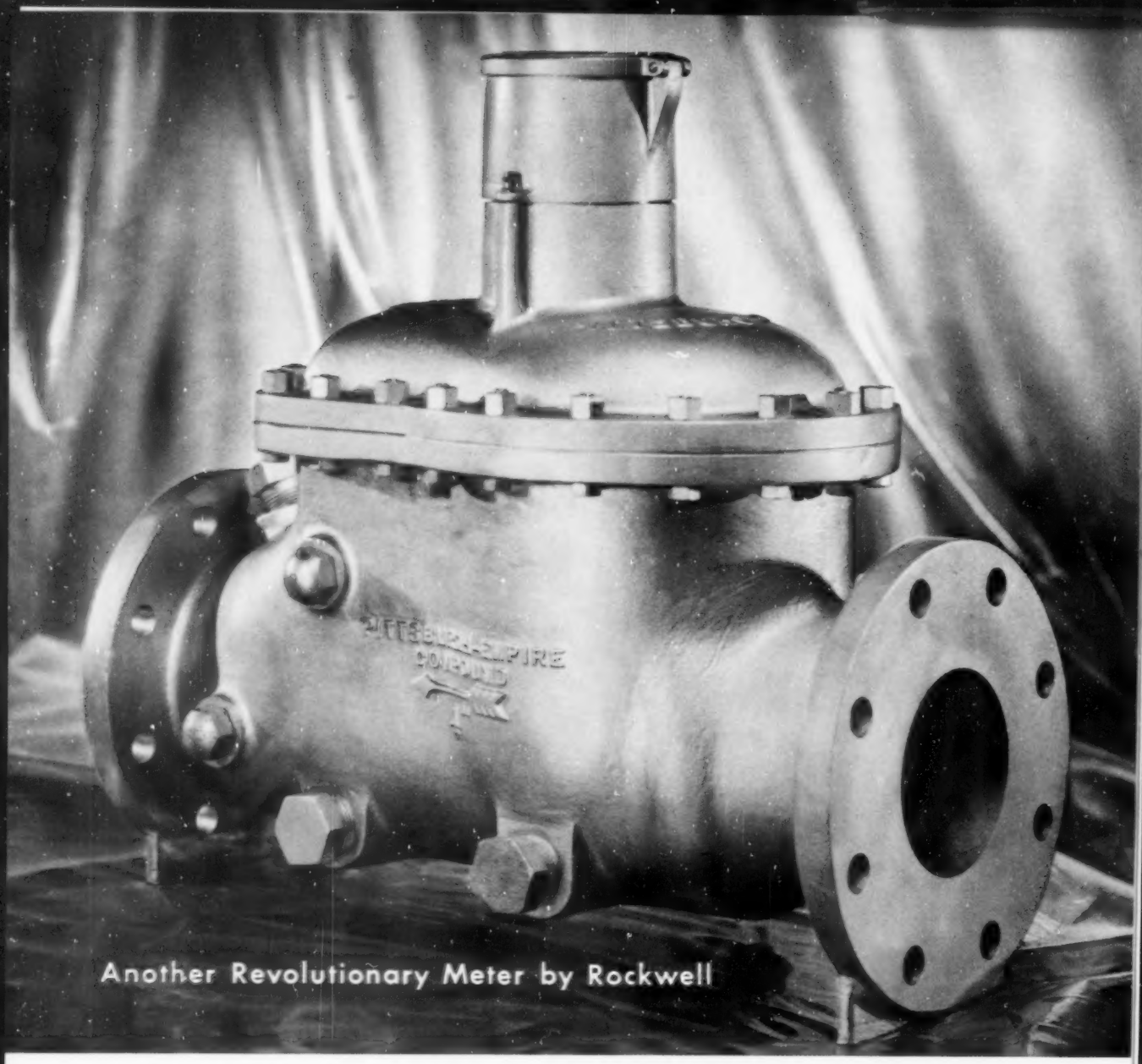
Simple tools needed to repair and little training needed.
Only two things to clean, measuring chamber and piston—no fitting of parts required.
One-half labor expense per meter.
No register to repair—no gear train to repair.
No stuffing box spindle, no driving dogs to replace.

4. NO STUFFING BOX LEAKS

No service required.
No expensive crew needed for this purpose.
No messy yard or basements—no customer complaints.
No register damage.

5. TAMPER PROOF

Register is inaccessible—no seal screws required.
Magnets are shielded.
Impractical to run back even with measuring chamber removed.



ALL THESE ADVANTAGES IN THE ROCKWELL SINGLE REGISTER COMPOUND METER

READS DIRECT TO AVOID ERRORS
The single register eliminates errors in reading and adding together the records from two registers.

LIGHTEST—MOST COMPACT
Size for size this meter is much more compact and lighter in weight than other compounds.

LOWEST PRESSURE LOSS
Horizontally mounted propeller with swing action compounding valve permits large volumes to flow in a straight-through path with lowest pressure absorption.

MANIFOLDING AVAILABLE
Two 4-inch Rockwell compounds furnished with complete manifold piping and valves will do a better job of measurement than a single 8-inch compound. This assembly is lighter, easier to install and simplifies maintenance since one side of the manifold can be shut down without interrupting service.

TURNS BOTH TRICKLES AND TORRENTS INTO DOLLARS
Small flows which ordinary compounds don't register are caught and accurately measured by this exclusive design. There is no detectable changeover point—no lost registration that reaches up to 15 per cent in conventional meters.

ROCKWELL MANUFACTURING COMPANY

Pittsburgh 8, Pa. Atlanta Boston Charlotte Chicago Dallas Denver Houston Los Angeles Midland, Tex. New Orleans New York N. Kansas City Philadelphia Pittsburgh San Francisco Seattle Shreveport Tulsa
In Canada: Rockwell Manufacturing Company of Canada, Ltd., Toronto, Ontario

(*Continued from page* 158)

the ground water level indicated it had a sandy-gravel texture. This study has demonstrated a method for tracing the movement of simulated chemical and bacterial pollutants in ground water. Uranin was found to be very satisfactory for determining direction of flow of ground water. A member of the enterococcus group of bacteria, *Streptococcus zymogenes*, was found to be suitable as an indicator or tracer organism to determine the extent of travel through the ground water.

"Experimental Ground Water Pollution at Anchorage, Alaska." By H. J. Fournelle, E. K. Day and W. B. Page. *Public Health Reports*, March.

Filter Underdrains Of Precast Concrete

One of the most recently developed filter underdrains is the precast concrete bottom designed by Chester Crist of the Columbus, Ohio, water filtration plant. It is a reinforced concrete unit 6-in. deep and 16 in. wide with three 4⅛-in. diameter laterals cast into each side. The length of the unit extends the full width of the filters. PVC plastic orifices, ⅜-in. diameter, are spaced at 6-in. centers along each lateral. Distinguishing features are uniform distribution of backwash, low loss of head in the underdrainage system, favorable cost comparison with other underdrainage systems, applicability to both new and rehabilitation work, shallow depth contributing to ease of use in rehabilitating old filters, resistance structurally to shock, castings of size to fit the filter, easy replacement of sand and gravel, no metallic surfaces in contact with water, avoidance of air binding, and no disturbance of the gravel even at excessive backwash rates.

"Precast Concrete Rapid Sand Filter Underdrain." By K. W. Cosens, Ohio State U. *Jour., A. W. W. Ass'n.*, April.

Army Develops Bigger Water Treatment Plant

The Corps of Engineers Research and Development Laboratories at Ft. Belvoir, Va., have developed a packaged water plant capable of purifying water at rates of 12,000 gph—enough to satisfy emergency requirements of 50,000 people. The new plant, designed for field erection, consists of three main all-aluminum sections: An "Erdlator" and two gravity type sand filters. The

"Erdlator"—also used in the Army's earlier truck mounted unit—is a cone-shaped upflow coagulation basin 14 ft. in diameter. Water pumped into the Erdlator is aerated, thoroughly stirred in the cone-shaped mixing tank with a coagulant (ferric chloride), a coagulant aid (pulverized limestone) and a disinfectant (calcium hypochlorite) and passed through a strainer where solids are removed. The water then flows into two open type gravity sand filters operated in parallel and the filter effluent is collected in a bolted aluminum water tank. The entire plant is housed in a 40 x 40 ft. building and can be operated by one man.

"Water Purification. Army Develops Bigger Water Treatment Plant." *Engineering News-Record*, March 21.

Reclaiming Sludge From Water Softening

The most popular method of reclaiming calcium carbonate sludge from water softening to date is that in which the carbonate is burned to the oxide in rotary kilns. A recently developed method, employed at Lansing, Mich., and proposed by Dorr-Oliver Inc. uses fluidized techniques and is known as the Fluo Solids process. It consists of burning the carbonate in an air stream in the presence of an agglomerating agent, resulting in an end product of practically dust-free, dense spheres, easily handled by air-conveying equipment. The process involves carbonation by water gas, concentration and dewatering in a centrifuge, and calcining the dried powder in the presence of sodium carbonate. The soda ash melts at the high temperature, producing a coating on the particles, causing them to build up to pellet size. The plant at Lansing, Mich., which produces 2.4 to 2.5 million pounds (dry basis) of sludge per month during fall, winter and spring months, has a reclaimed sludge capacity of 30 tons per day. Operating personnel consists of five employees covering 21 shifts per week.

"Softening Plant Reclaims Lime Sludge by 'Fluid Bed Roasting'." By Fred Krause, Lansing Board of Water and Electric Light Commissioners. *Water Works Engineering*, April.

Other Articles

"Estimated Use of Water in the United States, 1955." By K. A. Mackichan, U. S. Geological Survey. Jour., A. W. W. Ass'n., April.

"Water Conservation through **Control of Evaporation."** By B. W. Beadle and R. R. Cruse, Southwest Research Institute. Jour., A. W. W. Ass'n., April.

"Pollution of Ground Water." World Health Organization Report. Jour., A. W. W. Ass'n., April.

"Some Details of Water Treatment **Plant Design."** C. R. Harvill, Supt., San Jacinto Water System, Houston. Jour., A. W. W. Ass'n., April.

"Plastic Pipe in Water Supply Use." Panel Discussion. "Installation Methods in **Los Angeles."** By M. K. Socha, Asst. Chief Engr. of Water Works. **"Domestic Water** System Uses." John N. Spaulding, General Supt. of Water System, Pacific Gas & Electric Co., San Francisco. Jour., A. W. W. Ass'n., April.

"Anionic Synthetic Detergents and Water Supply Problems." By C. N. Sawyer, Mass. Inst. of Technology, and D. W. Ryckman, Washington U. Jour., A. W. W. Ass'n., April.

"Radioactive Matter in Water Supplies." Public Works, May.

"Lime Sludge Becomes **Fertilizer."** By Merle Fleming, Kenton, Ohio, Safety Service Director. American City, April.

"Fluoridation at the Chicago Avenue Pumping Station." By O. B. Carlisle, Chief Water Works Engineer. Water and Sewage Works, April.

"Inspecting and Repainting **Steel Water Tanks."** By J. O. Jackson, Pittsburgh-Des Moines Steel Co. Water and Sewage Works, April.

City of Sidney, Ohio

Gets Smooth Measurement of Sludge Magnetically!

...WITH FOXBORO MAGNETIC FLOW METER

"The Foxboro Magnetic Flow Meter on return activated sludge went into operation so smoothly that no one paid any attention to it. They haven't done a thing to it since, and it's still operating smoothly."

That's the comment of W. D. Sheets of Ohio State University, Technical Adviser for the new Sidney, Ohio, sewage plant. It's a typical perfect-performance report on the Foxboro Magnetic Flow Meter, a modern flow meter that's always easy to install, simple to operate, practically maintenance-free.

No line restrictions — no pressure taps to plug up. With the Magnetic Flow Meter, there's nothing in the line to cause pile-up of solids. And you can forget about purging of pressure taps — there aren't any! Electrical cable carries measurement signal to remote Dynalog* Electronic Recorder, providing a direct magnetic measurement of fluid velocity. Get full details on this unique development in flow meters. Write for Bulletin 20-14A. **The Foxboro Company, 266 Norfolk St., Foxboro, Mass., U.S.A.**

*REG. U.S. PAT. OFF.

FOXBORO
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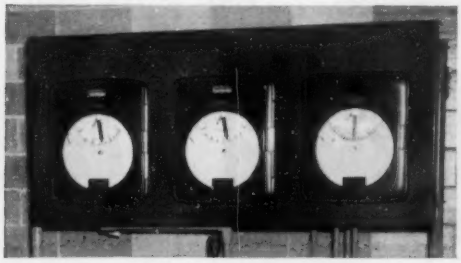
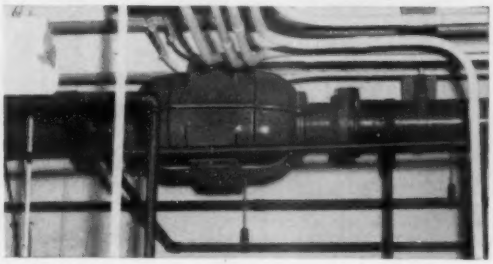
FIRST in FLOW

All Flow measurements are recorded by Foxboro Instruments centrally located in the plant director's office of the Sidney plant. Shown below, left to right, are: Air Flow Recorder with integrator; Sewage Flow Recorder with integrator; Dynalog Recorder for return activated sludge.





This compact, troublefree Foxboro Magnetic Flow Meter is installed right in the return activated sludge line at Sidney, Ohio's modern new sewage plant. There's nothing in the line to obstruct flow in any way . . . no pressure taps or purges.

MAINTENANCE FORCES ERECT BRIDGE IN ONE WORKING DAY

A MAINTENANCE crew from the Sumter, S. C. highway shop believes it has set a record in pre-cast concrete bridge construction time by erecting a 154-ft. bridge in seven hours and 15 minutes.

The site of the rapid construction is at Scape Ore Swamp on Secondary Road 41 in Sumter County. Twelve men, under the supervision of Maintenance Superintendent J. F. McIlwain, reported to the bridge site and began work at 7:40 a.m., February 5. At 3:35 p.m. that day, traffic was moving across the bridge. Work was actually completed 10 minutes earlier when the last tie rod was put in place.

Eleven 14-ft. pre-cast spans, furnished by Wallace Concrete Pipe Company, went into construction of the bridge. They are rated at H10 loading capacity, meaning that they were designed for a maximum load of 10 tons per vehicle axle.

The bridge's substructure, consisting of 60 treated timber piling and necessary falsework, had been completed prior to erection of the concrete spans. Approximately eight days were required to drive the 35-ft. piling to an average penetration of 20 feet.

Component parts of the bridge include concrete caps, which are pinned to the treated timber piling; reinforced concrete deck slabs, of which there are four per span; and reinforced concrete curb sections on both sides of each span. The deck and curb sections are held tightly together by one and one-fourth-inch steel rods, which pass through the sections and are secured with heavy nuts and washers at both sides. Slippage of the slabs upon the caps is avoided by the use of angle irons bolted to the bottom of the slabs.

Roadway width of the bridge is 24 feet between curbs. Treated and painted timber handrails, which are not included in the "kit" of parts, will be added later. The new crossing replaced an untreated timber bridge, which was considered inadequate after Road 41 was graded and bituminous surfaced last fall.

While this particular bridge was designed for a 10-ton per axle load, it actually is capable of safely supporting much heavier loads. This is demonstrated by the fact that a 22-ton power crane, used to lift the various parts into place, traveled all the way across the bridge while it was being erected. During a portion of the construction period, the spans were also supporting a 27-ton tractor-trailer truck combination which brought the bridge parts to the site.

The Highway Department has now been using pre-cast bridges in varying degree for about 12 years. Experience with their use has shown that they are not only constructed much more rapidly, but that they may be built at much less expense than a poured-in-place bridge of the same size and loading capacity. District 1 Maintenance Engineer W. M. Cook estimated that at least five months would have been required to construct the Sumter County bridge by conventional methods, and that the cost to the Department would have been much greater.

This article appeared in the March issue of *Carolina Highways*, an official publication of the South Carolina State Highway Department.

SPEEDING UP HIGHWAY ENGINEERING

This paper was given by H. A. Radzikowski, Chief Maintenance Branch, Bureau of Public Roads, at the ARBA Road Show in Chicago. This material has been slightly condensed.

HIGHWAY engineering procedures in Wisconsin have been streamlined to an increasing extent in the past three years. The number of engineers employed in 1954 per million dollars of capital outlay by the State highway department was 9.5. By 1955, the number of engineers was reduced to 5.5 per million dollars and in 1956 it was only 4.0 engineers per million dollars. Further reductions are anticipated.

This demonstration in Wisconsin that engineering productivity can be increased is being proven in many other States as well. How is this being done? If you were to examine the equipment inventories of a surprisingly large number of highway departments, you would detect a trend which will affect your operations significantly. For some of these inventories list electronic computers, radios, airplanes, aerial photographic cameras, stereoptic plotters, industrial television systems, facsimile equipment, and others which a year or so ago would have seemed extraordinary indeed. Why this change?

Our colleges and universities are producing between 4,000 and 5,000 civil engineering graduates each year. Of this number less than 1,000 enter the highway engineering field which is hardly enough to offset losses. It is clear that the additional engineering requirements of the new highway program will have to be met by increasing the productivity of the 33,000 highway engineers which we have.

The need for this increased engineering productivity is immediate, not at some distant date in the future. One hour after the President signed the Federal-Aid Highway Act of 1956 into law on June 29, 1956, the Secretary of Commerce signed the Certificate of Apportionment making available to the States for immediate use $1,125 million. In order to advance the program as rapidly as possible, an additional apportionment of $2,500 million was apportioned to the States on August 1, 1956.

What is the significance of these actions? A comparison will bring that out clearly. When the apportionment for fiscal year 1959 is made, probably on July 1, 1957, six and one-half billion dollars will have been apportioned to the States in one year. This is more than had been apportioned in any 14-year period in history. More Federal-aid funds will be available to the States in the first four years of the new program than in the previous 40 years of the Federal-aid program combined!

But has highway engineering productive capacity been able to take advantage of the availability of these large sums? At least a significant part of the answer to that question lies in the fact that in 1954, Federal-aid contracts advertised and funds obligated amounted to about $675 million; in 1955, this amount rose to $850 million; in 1956, it was over $1,500 million.

It is evident from these comparisons that there has been action and there has been accomplishment in increasing highway engineering productivity. However, more action must be taken to insure continued progress toward increasing engineering productivity to meet all the needs of the accelerated highway program.

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Absorption of Radioactivity On Trickling Filters

As a part of an overall study of detention times in clarifiers, the passage of radioactive material through a trickling filter was investigated. Rubidium^{86} was added to the primary clarifier when the sewage flow was constant at 2.6 mgd. Using fluorescin dye, the flow time through the trickling filter was determined to be 4 minutes; hence, influent and effluent samples were taken 4 min. apart. The radioactivity in the effluent decreased 91 percent in 30 min. The results indicated adsorption taking place in the zoogleal mass on the filter rock, followed by slow leaching. Analyses of the mass showed that more radioactivity was adsorbed at the 1-ft. level than at the filter surface. A small amount of radioactivity was absorbed by the rock.

"Absorption of Radioactive Rubidium on Trickling Filters." By E. B. Fowler, E. R. Baumann, and Homer Ambrose, Jr., Iowa State College. *Sewage and Industrial Wastes,* April.

Intercommunity Sewage Plant

A study of the sewage and industrial waste disposal problems in the Williamsport, Pa., area led to the recommendation that two plants be constructed, one on the west side of Lycoming Creek and a central plant which would serve the Borough of South Williamsport and Loyalsock Township as well as the major portion of the City of Williamsport. The Williamsport Sanitary Authority was established to effect construction and operation of the facilities. The Central Plant, designed for an equivalent population of 60,000 and a sewage flow of 5.15 mgd, consists of a bar screen, mechanically-cleaned grit channels, two pre-aeration tanks, three primary settling tanks, chlorine contact chambers, and an elaborate sludge handling system. Sludge is pumped to decanting tanks which also receive scum from the primary settling basins. Excess water may be removed before the sludge is pumped to the digesters, with lime addition if necessary. There are three digesters, one with a floating cover and two equipped with gasometers. Exterior heat exchangers are provided. Countercurrent sludge elutriation precedes dewatering of the sludge by coil-spring vacuum filters. A furnace, utilizing either oil or digester gas, is available for further drying or incinerating the sludge.

"Central Primary Plant Will Handle Sewage from Three Municipalities." By T. R. Haseltine, The Chester Engineers. *Wastes Engineering.* April.

Miami High-Rate Activated Sludge Plant

Miami's pollution abatement program has become an accomplished fact with the completion and placement into operation of the city's new activated sludge plant in September, 1956. The program consisted of the construction of intercepting sewers, pumping stations, a force main across Biscayne Bay, a treatment plant on Virginia Key, and an ocean outfall. The treatment plant has been designed to operate as a high-rate activated sludge plant but is laid out to permit the adoption of either the "step-aeration" or the "biosorption" process if experience indicates it to be desirable. The design capacity of the treatment plant as now built is 47 mgd, which is the estimated average sewage flow in the winter of 1965. The grit chambers, conduits, and outfall are designed for a maximum flow of 153 mgd. The average winter flow in 1980 is estimated to be 68 mgd, which is 45 percent greater than the design flow of 47 mgd. Space has been reserved for a 50-percent increase in secondary treatment and in sludge disposal units, including aeration tanks, final settling tanks, blower facilities, sludge concentration tanks, sludge digestion tanks, and vacuum filters.

"Miami High Rate Activated Sludge Plant in Operation." By E. Sherman Chase and John S. Bethel, Jr. *Civil Engineering,* April.

Shopping Center Sewage Treatment

Two Florida shopping areas, one in Miami and the other in Jacksonville have provided their own sewage treatment plants. The Miami project will serve seven buildings with 488,000 sq. ft. of sales area. The sewage plant is underground, beneath the central plaza. It consists of pneumatic ejectors for pumping, a "Spirahoff" clarifier and digester, a flotation unit for grease removal, water wheel distributor trickling filter and a chlorine contact chamber. Sludge is removed by truck. The Arlington Plaza Shopping Center is four miles east of Jacksonville and has 250,000 sq. ft. of rentable floor space. At the request of the shopping center developers, the sewage treatment plant was overdesigned purposely to take care of sewage from 25 owners of adjacent property. The disposal facilities consist of a lift station, "Spirahoff" clarifier and digester, high rate trickling filter, secondary clarifier, chlorine contact chamber, and sludge drying beds. Provision is made for recirculation of the secondary effluent when the lift station pumps are not operating.

"Sewage Treatment for Shopping Areas." By C. E. Wright. PUBLIC WORKS, May.

Quantitative Design Data for Stabilization Ponds

Parameters for the relationship of the depth of the detention period of a stabilization pond and for the capacity of a pond to produce oxygen in relationship to BOD loading are essential to efficient design. The visible portion of sunlight is an extremely variable factor, but it may be predicted with reasonable accuracy over long periods of time. The amount of energy associated with oxygen liberation by algae is well established. The photosynthetic efficiency required to meet the oxygen requirements of a waste under varying conditions of depth, detention period and illumination, can be determined and is called the critical efficiency. The oxygenation factor,

the ratio of photosynthetic efficiency actually obtained to the critical efficiency, can be used as a parameter for stabilization pond design. An oxygenation factor of 1.2 to 1.8 is considered essential for continuous maintenance of aerobic conditions. At about 1.8, excess algae growth leads to a high pH which can inhibit bacterial oxidation. The loading factor, defined as the ratio of depth to detention period can be experimentally determined with respect to a given oxygenation factor. Under summer conditions the maximum loading factor is about 5.2 at a detention period of about 3.5 days. Under winter conditions, it is 2.3 at a detention period 5 days.

"Algae in Waste Treatment." By W. J. Oswald, H. B. Gotaas, C. G. Golueke, and W. R. Kellen, University of California. *Sewage and Industrial Wastes*, April.

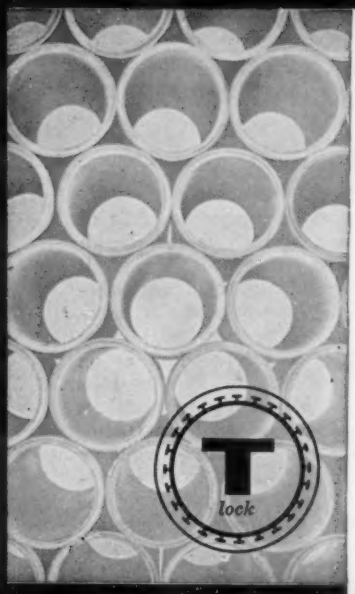
Plant With Digester Murals

In 1954, the City of Coral Gables, Fla., commenced a program which will eventually provide a city-wide sewage collection system, in place of the individually owned septic tanks previously used. Flat topography and high groundwater elevations necessitated the use of flat grades and several pumping stations. Architectural treatment of the lift station structures blends with buildings in the respective surrounding areas. The sewage treatment plant is adjacent to the campus of the University of Miami, which led to the design of an efficient and attractive plant. The operations building includes class rooms and facilities for sanitary engineering students of the University. The plant includes an aerated grit chamber, primary clarifiers, activated sludge treatment units, secondary clarifiers, sludge digesters, pre- and post-chlorination units, a vacuum filter, and a sludge flash dryer. The nominal present capacity is 2.5 mgd with provisions for expansion to 7.5 mgd. Operating at less than 50 percent of design capacity, the plant averages BOD removals of 94 percent and suspended solids removals of 85 to 90 percent. The City commissioned artist John St. John to provide the murals on the digester walls to depict symbolically 450 years of Florida history.

"In Coral Gables, Fla., It's Operation Health and Beauty." By Wylie Gillespie and C. W. Smith, Consulting Engineers. *Water and Sewage Works*, April.

Raw Sewage Stabilization Ponds

As a part of a plan that is nationwide in scope, the U. S. Public Health Service has been engaged in field studies of raw sewage stabilization ponds in the Northern Plains States. Each facility was subjected to a 3-day observation period during all seasons of 1955, using mobile laboratories set up at convenient locations. Objectives were to provide a better understanding of the stabilization mechanism, to evaluate variables in design, loading and season, to review and develop interim criteria for the particular geographical area, and to determine objectives of future studies. In the winter in the Northern Plains, the ice cover prevents algal photosynthesis and the processes become anaerobic, but the ice prevents nuisance conditions except during the transition period from ice cover to open water. Reductions in coliform density were 99 percent more than 50 percent of the time and 95 percent or greater at all times. In terms of BOD, the organic load was reduced by a minimum of 43.6 percent and by a maximum of 98.4 percent. Light penetration was measured during each season using matched surface



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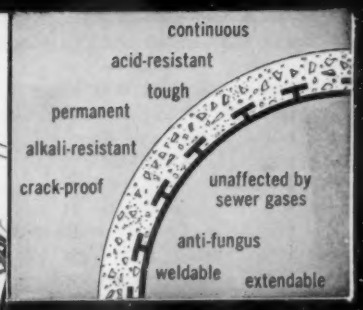

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and submerged photronic cells, and oxygen production at prevailing light intensities was observed. Differences in light penetration were noted at the same depths in different ponds, because of algal density. The Dakota experience indicates that at the design standard of 100 persons per acre of water surface and with low rainfall and high evaporation rates, little overflow will occur and the recovery in the Spring will require a minimum number of days. There appears to be no advantage in having depths greater than 3 or 4 ft.; the shallower depths promote better mixing and better spreading of settleable solids by wind action. It is desirable to maintain a uniform depth. Islands, coves and peninsulas should be avoided. Inlets should be sufficiently far removed from the shore to insure that wind action will contribute to the dispersion of solids. Multiple inlets do not appear to be necessary. Even though odor production ocurred during the Winter-Spring transition period, it was not sufficient to justify complaints. Cost data showed that per capita expenditures varied from $4.40 to $37.94 per capita, with the average, $14.84.

"Raw Sewage Stabilization Ponds in the Dakotas." By W. W. Towne, A. F. Bartsch, and W. H. Davis, R. A. Taft Sanitary Engineering Center. *Sewage and Industrial Wastes,* April.

Refuse Disposal By Sanitary Fill

In sanitary fill operation, cells of refuse are progressively developed; the level of the terrain is raised; and refuse is compacted and covered with a minimum of dirt moving. In the ramp method, refuse and garbage are dumped at or on the working face of a natural or constructed ramp; the material is spread and compacted by a tractor to one-fourth its original volume; dirt for cover is dug from an adjacent area and is spread over the refuse with additional compaction occurring; and the next cell is started by dumping refuse over the ramp just completed. The working face of a ramp should slope no more than 30 degrees. A town of 10,000 population can purchase the necessary equipment for $10,000. Advantages for this method of refuse disposal include avoidance of unsightly dumps, low initial investment, low operation and maintenance costs, flexibility, and reclamation of land areas.

"Sanitary Fill by the Ramp Method." By J. E. Skornicka, Jr., Drott Manufacturing Corp. PUBLIC WORKS, May.

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"Operation Experience with Activated Sludge—**Biosorption at Austin, Texas.**" By A. H. Ullrich and M. W. Smith, Supt. of Water and Sewage Treatment and Plant Supt. Sewage and Industrial Wastes, April.

"**Research Grants** in Sanitary Engineering—A Progress Report." By H. A. Faber, U. S. Public Health Service, Sewage and Industrial Wastes, April.

"Experimental **Vertical Screen** Trickling Filter." By K. L. Schulze, Michigan State University. Sewage and Industrial Wastes, April.

"**Anaerobic Contact Process** for Sewage Disposal." By J. B. Coulter, S. Soneda, and M. B. Ettinger, R. A. Taft Sanitary Engineering Center. Sewage and Industrial Wastes, April.

"Effects of **Garbage Grinders** on Sewers at Tucson, Arizona." By Kenneth Scharman, Manager, Sanitary District. Sewage and Industrial Wastes, April.

"Services of the **Petroleum Products Supplier.**" By D. S. Taber, Socony Mobil Oil Co., Inc. Sewage and Industrial Wastes, April.

"**Safety First** Pays Off: The Operator You Save May Be You." By R. E. Simon, Orlando, Fla., Sewage Plant Supt. Wastes Engineering, April.

"**Concrete Sewer** Protection." By L. A. Pardee and E. G. Studley, En-

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Factories:
Milwaukee, Wis.; Hillside, N. J.; Lancaster, Pa.

gineers, City of Los Angeles. Water and Sewage Works, April.

"Toward A **Cleaner Potomac River** Alexandria, Va., Does Its Part." By J. J. Corbalis, Jr., Engineer-Director, Alexandria Sanitation Authority. Water and Sewage Works, April.

"**Cold Weather** Waste Treatment Plant." By R. L. Smith and H. C. Leibee, Consulting Engineers, Public Works, May.

"**Measuring Sewage** Flow from Schools." By C. H. Coberly, Coberly-Leffel, Engineers, Inc. Public Works, May.

"Sewage Reuse Urged as **Water Saving.**" Engineering News-Record, April 11th.

"Weigh Refuse **Electronically.**" By C. A. Rogers, New York City Dept. of Sanitation. American City, April.

"**Voters Back** Second Sewage Plant." By H. C. Wolfe, Russell and Axon. American City, April.

"Make Sure the Sewerman Has the **Right Clothing and Equipment.**" Municipal Engineering, April 5.

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New Water Facilities for Columbia, S. C.

FURTHER expansion of the Columbia, South Carolina, water system has been recommended to meet consumption demands of the metropolitan area for the next 30 years. Costs of new pumping, purification, storage and distribution facilities are estimated by B. P. Barber and Associates, engineering consultants of Columbia as $9,300,000. The City Council retained the firm to make a detailed study and analysis of the city's future water system needs to supply all residents of Richland County within a six-mile radius of the State Capitol building. Projected improvements will be undertaken in two phases, the first expansion, costing an estimated $6,500,000 will begin as soon as funds are available.

Initial improvements will extend capacity of the present water treatment plant from 27 million to 42 million gallons per day; add two new elevated storage tanks; build a new raw water pumping station; and augment principal distribution mains. Treatment plant improvements will include new settling basins, chemical treatment and filtration, high service pumps and clear-water storage basins.

Extent of 1953 expansion of the Columbia water plant, costing $1,113,000, was limited by the borrowing power of the city at the then existing water rates. At that time, municipal bond officials informed the city that a larger revenue bond

issue could be obtained later to meet water consumption needs of the Columbia area if water rates were revised and the number of city water-consumers continued to grow. A 20 percent increase in water rates established last July 1 was the first step in providing funds for the expansion now contemplated.

The expansion is a long-range program recognizing the city's responsibility as the hub of a metropolitan area of over 150,000 residents and the prime source of water for its growing population.

Consumption demands for the coming 30 years were based on population estimates for the greater Columbia area (excluding suburbs in adjoining Lexington County). The city's current population estimate is 115,300, while that of the metropolitan area served is 142,800. The figure for the latter is expected to increase to 151,900 in 1961; 168,000 in 1966; 187,000 in 1971; 204,000 in 1976; 216,240 in 1981 and 227,000 by 1986. Maximum daily water consumption at present is 26,214,000 gallons, which is expected to rise by 1961 to 32,233,000; by 1966 to 38,059,000; by 1971 to 45,422,000; by 1976 to 52,800,000; by 1981 to 60 million gallons; and by 1986 to 67,330,000 gallons.

The initial expansion should be sufficient to meet consumption needs of the area until 1968 when the water system can again be augmented by additional facilities which will bring its total capacity to 60 million gallons per day. This later expansion will be sufficient to care for the Columbia-vicinity demand through 1986.

The second phase of the expansion program will include the installation of additional raw water pumps in the pumping station, added settling basins, chemical treatment facilities, filtering equipment and storage basins. The cost of the second step combined with the interim cost of storage facilities and lateral mains will be approximately $2,800,000. The city will continue to expand its distribution system to a capacity of 69 million gallons daily as new water consumers are added.

Columbia gets its water from the Broad and Saluda Rivers, the combined minimum daily flow of which is about 215,000,000 gallons, "sufficient not only for the forseeable future growth of the city but for considerable industrial use", the Barber report notes. Irving G. McNayr is City Manager: Harry O'B. Bellinger is Public Works Director; and Dr. P. J. Philson is Superintendent of the Water Plant.

Amount of Motor Fuel Sold on the New York Thruway

A total of 22,861,269 gallons of motor fuel was sold at the New York Thruway stations during 1956. The per-gallon payments to the Authority from the oil companies range from 8.03 cents to 6.51 cents.

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Evaporation Control

(*Continued from page* 102)

in the work in Texas and in the program of the U. S. Bureau of Reclamation in Oklahoma.

In the laboratory one hundred forty-six samples of potential evaporation retardants have been screened. In selecting the materials the minimum molecule size was arbitrarily taken at ten carbon atoms; it was felt that a smaller molecule would present problems of excessive volatility, odor, or inadequate film thickness. The homologous straight chain primary fatty alkanols were found to be the best evaporation retardants. One secondary alkanol showed some promise, as did one tertiary amine and a few miscellaneous compounds. The silicones showed some degree of evaporation reduction, but not enough to be considered at the present time. The fatty acids described by LaMer as being quite effective in retarding evaporation, did not work under conditions used, and in the field, the presence of calcium or magnesium ions would obviously vitiate the performance of a film of a fatty acid.

The compounds showing the highest percentages of evaporation reduction in the screening apparatus were further evaluated in a set of two stock tanks, 10 feet in diameter and buried in the ground to within two or three inches of the top. One tank is used as a control; the test film is applied to the other. Thus, any changes in wind or other climatic conditions are automatically compensated. Changes in the water levels in the tanks are determined twice daily by means of a hook gauge; the actual evaporation occurring is thus obtained, and relative film performance can be quickly calculated. The 10 foot tanks give an indication of the performance which might be expected of an evaporation retardant under larger scale field conditions.

For larger scale tests, a four-acre artificial lake on the Essar Ranch, adjoining the Southwest Research Institute has been used. In cooperation with the U. S. Geological Survey, Denver, Colorado, the basic evaporation and seepage characteristics of the lake have been determined. The energy budget technique, developed by the U. S. Geological Survey has been used in the calculations of the film performance on the lake. Instrumentation for determination of energy changes has been set up by the U. S. Geological Survey as well as instruments for recording the surface temperature of the lake and determining wind movement and changes in the elevation of the lake surface. Southwest Research Institute personnel have made daily or weekly readings of the instruments and the resulting data have been processed by the U. S. Geological Survey. A reduction in the evaporation rate of up to 18 percent has recently been achieved, and tests to develop means of improving this figure are in progress.

The films on both the 10-foot tanks and on the lake are now generated by placing a floating raft cage or a number of them as needed, filled with hexadecanol or other evaporation retardant under test, on the surface of the water and anchoring them in place. The film

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spreads out from the solid material in the reservoir, and stops when the film has covered the lake. If the film is ruptured by boats, fish, swimmers, or other moving objects in the water, more film is generated from the reserve supply of material in the raft. Rain, also, may rupture the film which is then regenerated with assistance from the raft reserve.

In the 10-foot tanks the raft is made from aluminum or copper bronze screen and large corks. On the lake, the rafts are made of 2 in. x 4 in. lumber, heavily varnished, in an "H" shape, and covered with aluminum or copper bronze screen. The former was found to be clogged rapidly by algae.

Two of the major problems still confronting a completely successful monofilm evaporation reduction technique are the actions of microorganisms and wind. The Australians have stated that the film will spread upwind; preliminary laboratory results at Southwest Research Institute indicate that this occurs very slowly. Additional data are needed. Visual observations on the Essar Ranch Lake indicate that the film is definitely piled up downwind, and is not fully compressed upwind whenever a wind of about 10 mph velocity or greater is blowing.

A greater problem is that of microorganisms. Apparently no difficulty with algae or bacteria has been experienced in Australia. As a part of our investigation into the biological and biochemical phases of the work in this country, the Robert A. Taft Sanitary Engineering Center of the Public Health Service, Cincinnati, Ohio, has undertaken to research into these phases of the overall study. Their preliminary results, utilizing raw Ohio River water indicated a definite consumption of hexadecanol by biochemical oxidation. While water of the degree of pollution of that in the Ohio River is not usually found in the water impoundments of municipalities, the fact that hexadecanol was subject to bacterial oxidation could not be denied. Investigators at North Texas State College, working on the limnology of Kid's Fishing Lake, near Oklahoma City, Oklahoma, in cooperation with the film studies of the U. S. Bureau of Reclamation have confirmed the fact that bacteria will consume the alkanols when used as film forming evaporation retardants. In the program at Southwest Research Institute, the research conducted through the first nine months of 1956 showed that the film possessed an extremely short film life. About the first of October, experiments were undertaken to suppress microbiological action. The addition of 0.6 ppm Cu, as cupric sulfate pentahydrate, to the 10-foot stock tanks resulted in increasing the effective life of the test film of from 5 to 8 days to more than six weeks. The film was still operating at the end of this period, when the test was terminated in order to investigate another aspect of this phase of the problem. During this period, the efficacy of the film varied from nil, right after a rainstorm, to 91 percent reduction of evaporation during a warm, windy spell. The over-all average saving was about 40-45 percent. In this same test, it was noted that the raft in which the reserve supply of hexadecanol was stored did not become clogged with algae as rapidly as it did when the copper additive was not used. Evaluation of hexadecanol admixed with bacteriostatic or bactericidal agents is in progress.

To date, no detrimental effects of the film have been noticed in tests on the lake in regard to fish, including fingerling; frogs; migratory wild fowl using the lake as a stopover for rest, food, and water; water moccasins and other snakes; and various forms of marine plant life in the reservoir. Some of the latter—as lily pads, and plants whose leaves rest on the water surface—offer barriers to the spreading of the film, and may completely block the film if growth is sufficiently dense.

Indications are that an evaporation retardant film in operating condition will assist in preventing the freezing over of a reservoir. During a short, sharp cold spell, January 16-17, 1957, a film of ice about 1/16 inch thick covered the entire surface of the control tank; no ice was noted on the treated tank.

It has been calculated that, on the basis of an application rate of 2.2 pounds of evaporation retardant per acre, a reduction in evaporation of 45 percent and a film life of thirty days, the cost of saving (or producing) an acre-foot of water is about $1.60, or approximately one-half cent per thousand gallons.

New Sewer is Constructed Inside a Storm Sewer

IN A PROGRAM designed to separate sanitary and storm sewers, providing a system for each, Topeka, Kans., came up with a different solution; and this plan also solved the problem of backing up of sewage after heavy rains. Examination of the area by Paden & Bartlett, Consulting Engineers, showed that the area was served by an old brick sewer, 54 ins. by 71 ins., which was built more than 70 years ago.

To provide for domestic sewage in the area, a new 18-inch line was laid inside the existing sewer, using vitrified clay pipe without bells. Though every effort was made to prevent entrance of sewage into the old line during construction, there was some interference with the work. However, good construction was obtained by laying the pipe on blocks; the joints were covered and the covering wired to prevent entrance of concrete into the joints; and the line was then completely encased in concrete.

The saving in cost over trenching and complete new construction was considerable and the new line has been giving satisfactory service.

● **SOME sewage entered old line, adding to the usual construction problems.**

● **JOINTS were securely covered and the new line fully encased in concrete.**

It should be borne in mind that water evaporated from a reservoir is essentially pure water. The dissolved solids present in the reservoir remain there. Hence, if evaporation can be retarded, some reservoirs now considered marginal from the solids standpoint may be kept suitable for use, and thus, if the cost of treatment should prove to be somewhat higher than the figure of one-half cent per 1000 gallons saved from evaporation, the worth of the entire water content of the reservoir should also be considered.

The ultimate objective of this program will be to develop a practical and inexpensive method for reservoir evaporation control that will be of maximum benefit to water users of the Southwest, the United States and the world.

This paper was presented at the 39th Texas Water and Sewage Works Association's Short School, Texas A & M College, College Station, Tex.

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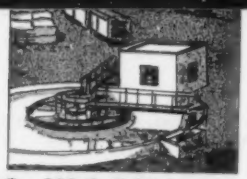


PUBLIC WORKS DIGESTS

THE INDUSTRIAL WASTE DIGEST

Refinery Waste Treatment

To meet provisions of stream pollution regulations, the Skelly Oil Co. designed "model" oil refinery waste treatment facilities at its El Dorado, Kansas, plant. With the El Dorado refinery having a production capacity of about 45,000 bbls. per day, a primary treatment unit for the wastes handles 15,000 gpm, drawn from a 110-acre drainage area. Representing an expenditure of $500,000, the present units consist of A.P.I. separators to remove settleable oil from waste which is first passed through a bar screen. Gates, which are adjustable horizontally to permit floating oil to flow to the separators at all times, divert excess volumes of water to an impounding basin. The overflow from the basin is pumped back to the treatment unit. The impounding basin made it possible to reduce the size of the separator by 85 percent. The waste enters the plant through a concrete forebay which, like the separators that follow it, is equipped with Link-Belt sludge collectors and skimmers. The portion of the waste which is piped to the plant enters a similar forebay—separator system. The effluent from the separators is discharged to Walnut River. Oil removed, amounting to 200 bbls. per day, is processed for reuse. A pilot plant has been erected for studying the possibility of secondary treatment to remove or oxidize soluble materials and reduce BOD. Biological trickling filters are being investigated.

"Refinery Removes Oil Waste from 45,000 - Barrel - Daily Operation." *Wastes Engineering,* April.

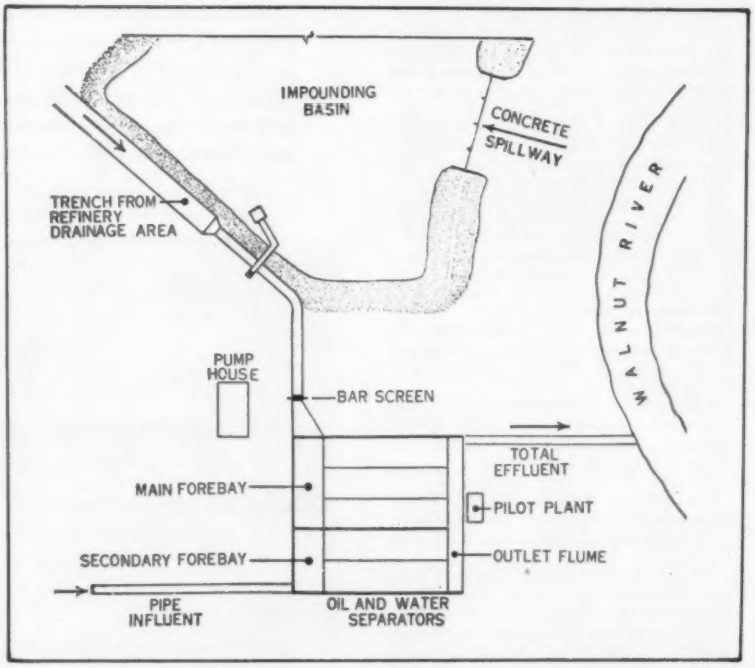
Laundry Waste Treatment With or Without Sewage

Most laundries use soap as a detergent, aided by the use of alkalies such as sodium carbonate, trisodium phosphate and the alkaline silicates. A few may employ the nonionic or anionic synthetic detergents for washing wool or specialty items. Factors which affect soap usage include: amount and type of soil present in clothes, size of load in relation to washer capacity, bicarbonate content, and type and quality of washroom supplies. Typical waste analyses show the pH to be between 9.0 and 9.3, alkalinity 60 to 250 ppm, total solids 800 to 1,200 ppm, and BOD 400 to 450 ppm. The waste undergoes decomposition on standing. All but a small percentage reaches sanitary sewers, and the wastes may be readily treated in the presence of domestic sewage by methods now employed. If the wastes must be treated separately, chemical precipitation using sulfuric acid, calcium chloride, lime, copperas, alum and ferric alum has been applied. Mixing, flocculation and settling are the mechanical processes involved. These can be followed by lagooning for several days or filtration through sand filters. Chemical dosages can be adjusted by periodic sampling, and in some cases pH determinations may be required to ascertain the amount and type of treatment required. Investigators have reported favorable results using trickling filters, but the method is not known to be used by any commercial laundry.

"Learn to Live with Laundry Wastes—Most of It Goes into Your Sewers!" (Excerpted from publication No. 509, U. S. Public Health Service.) *Wastes Engineering,* April.

Combined Sewage and Industrial Waste Treatment

If the fundamental objective of a sewage treatment program is to preserve the quality of the receiving body of water and assuming that this objective must be met at a minimum cost to the community in general, it is almost axiomatic that one large treatment plant is cheaper to build and operate than many small ones. Combined treatment of municipal and industrial wastes, therefore, offers excellent advantages to the community. To achieve the de-

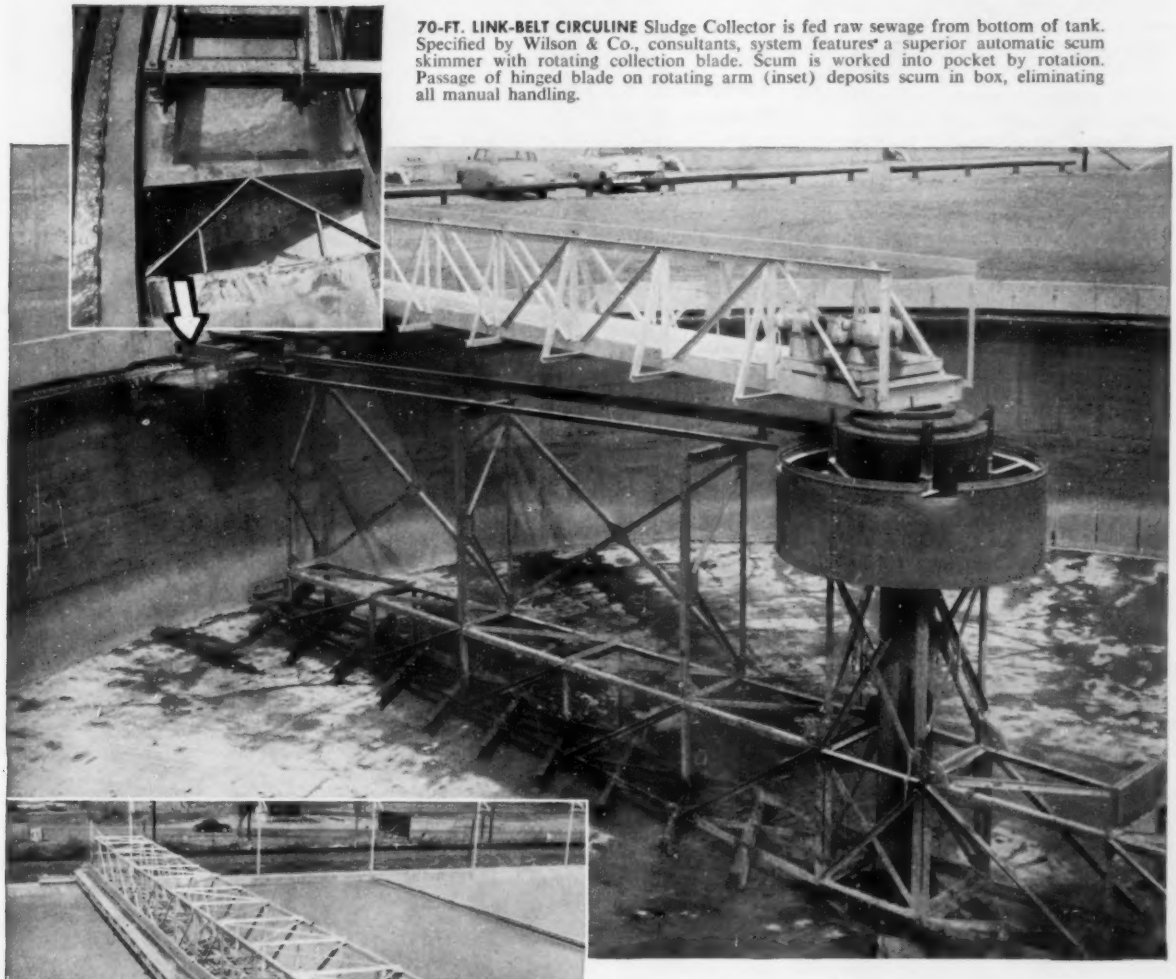


Courtesy Wastes Engineering

● **LAYOUT of waste treatment plant at Skelly Oil Company's El Dorado refinery.**

LINK-BELT equipment helps bring Manhattan, Kansas

low-cost sewage treatment



70-FT. LINK-BELT CIRCULINE Sludge Collector is fed raw sewage from bottom of tank. Specified by Wilson & Co., consultants, system features a superior automatic scum skimmer with rotating collection blade. Scum is worked into pocket by rotation. Passage of hinged blade on rotating arm (inset) deposits scum in box, eliminating all manual handling.

TRAVELING BELT CONVEYOR conveys dry sludge from 10 drying beds to trucks, thus reducing manual handling of sludge to a minimum. Push-button control station (circled) permits operator to move bridge automatically as removal progresses.

Circuline sludge collectors with automatic scum skimmers and traveling belt conveyor mechanize sludge collection and disposal

Like so many municipalities and industrial plants, the city of Manhattan uses Link-Belt Circuline Collectors for quick, low-cost sludge and scum removal. This integrated system incorporates a traveling belt conveyor and automatic scum skimmers—provides efficient, positive sludge removal . . . minimizes manual handling.

Link-Belt can apply a complete line of sanitary engineering equipment and extensive experience to your water, sewage or industrial waste treatment problems . . . will gladly work with your chemists and consultants. Call your nearby Link-Belt office.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

14,409

sirable objective costwise, it is essential that charges levied on industry by the municipality reflect actual unit costs for the elements involved. A survey conducted by sending questionnaires to 200 sewage plants showed that the median treatment plant handled industrial waste loadings of 25.5 percent of total flow, 36.5 percent of the BOD, and 32.5 percent of suspended solids. Forty percent maintained general prohibitions against explosive, toxic, or damaging materials; 11 percent placed numerical limits on amounts or concentrations and 49 percent indicated no limitations. Obligations of the parties involved are summarized in the following points: Industry should reduce or eliminate wastes that cannot be handled by the municipality; industry must reduce or eliminate contaminants that are more economically handled by industry; industry should pay its fair share of the cost; and industry should furnish the municipality necessary information to permit evaluation of the effect on the treatment plant. The chief obligation of the municipality is to treat all wastes that can be handled satisfactorily more economically than could be done with partial or complete treatment by the industry. The success of a combined operation is based to a large extent on a cordial spirit of cooperation between the municipality and industry.

"Combined Treatment of Industrial and Municipal Wastes—an Industrial Viewpoint." By J. F. Byrd and V. E. Gex, Procter and Gamble Co. *Sewage and Industrial Wastes*, April.

Spray Irrigation of Cannery Wastes

The maximum BOD loading in the Touchet River in Washington during the 1956 canning season was 295 ppm compared with 600 ppm during 1955, attributable to the action of the Green Giant Cannery in using spray irrigation to dispose of the strongest wastes, reducing the load on the Dayton municipal sewage treatment plant. The cannery applied 400 gpm to 20 acres of land planted with pasture grass, using a rate of 4 acre-inches per day in 5-day cycles. Fifty spray nozzles delivered 8 gpm each at 50 psi. The waste water consisted of blancher waste, blancher spray reel waste, and sufficient plant effluent to maintain an average BOD of 5,000 ppm. The irrigation tract consists of 100 acres, of which 80 acres are planted in asparagus. When the asparagus reaches maturity in about five years, the asparagus will replace the grass on the remaining 20 acres, and the entire tract will be used for disposal of the cannery effluent. On the 20-acre tract used in 1956, ponding in some areas damaged the grass and contributed odors.

"Effect of Cannery Waste Removal on Stream Conditions." By J. V. Lunsford, Washington State College. *Sewage and Industrial Wastes*, April.

Air Pollution Prevented By Chlorine Recovery

The venting of excess chlorine by the alkali industry contributes to air pollution and is no longer necessary, thanks to a process developed by Diamond Alkali Co. The chlorine "snift gas" for which there has been only a limited market heretofore, can be subjected to chlorine recovery at a cost of only $20 per ton of reclaimed chlorine, which in turn can be marketed for $60 per ton. In the process, the chlorine, about 20 to 50 percent in the snift gas, is absorbed differentially in carbon tetrachloride and is then removed in a steam-heated stripper. A typical recovery unit processes a chlorine—air mixture containing about 35

Carrollton, Mo., Sewage Treatment Plant.

Consulting Engineers,
Haskins, Riddle & Sharp, Kansas City, Mo.

General Contractor,
Curtis F. Veach, Tipton, Mo.

Major Equipment:
Sludge Pumps, Chicago Pump Co.

Main Sewage Pumps, Fairbanks, Morse & Co.

Clarifiers, Lakeside Engineering

Distributor and Floating Cover, Pacific Flush Tank Co.

Comminutor, Worthington Corp.

And Now.. Carrollton Uses Trickling Filters

with TFFI specification vitrified clay underdrain blocks

For the same 6 good reasons that are causing consulting engineers all over America to specify them in sewage and wastes treatment plants everywhere. They are:

1 LOW COST. First costs are reasonable, and low-cost operation will save your community money.

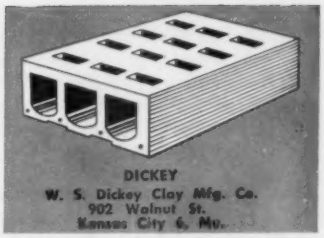
2 SIMPLE, EASY OPERATION. In most plants one man in a 40 or 44-hour week can do the work.

3 LONG LIFE—longer than the life of the bonds issued to pay for them.

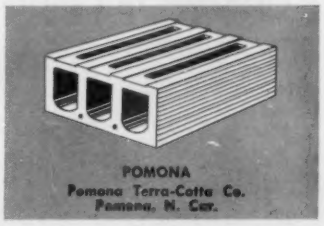
4 GOOD RESULTS—top notch effluent—say 20 ppm BOD, day after day, year after year.

5 RELIABILITY distinguishes their performance always.

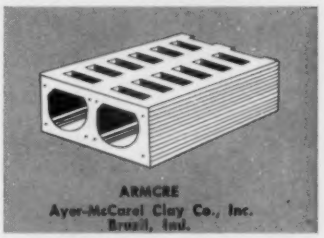
6 OVERLOAD IS NO PROBLEM. Take temporary shock loads—or those of a new industry—right in their stride.



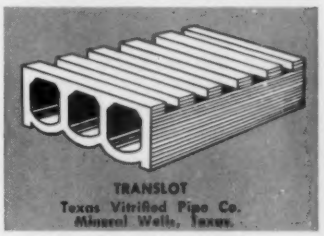
DICKEY
W. S. Dickey Clay Mfg. Co.
902 Walnut St.
Kansas City 6, Mo.



POMONA
Pomona Terra-Cotta Co.
Pomona, N. Cal.



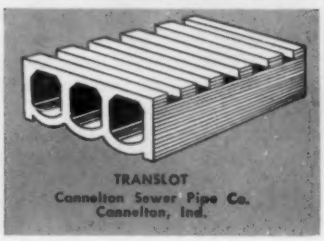
ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.



TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas

BOSCO
Bowerston Shale Co.
Bowerston, Ohio

NATCO
Natco Corporation
327 Fifth Ave.
Pittsburgh 22, Pa.



TRANSLOT
Connelton Sewer Pipe Co.
Connelton, Ind.

TFFI

Symbol of good treatment

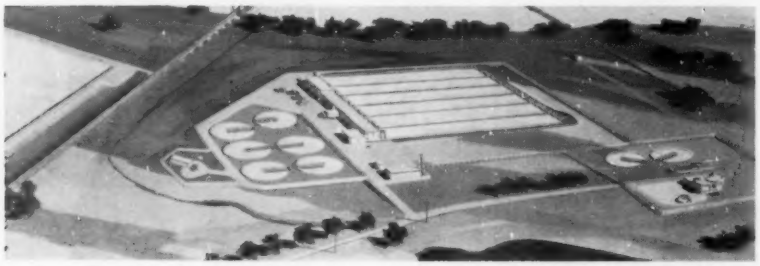
TRICKLING FILTER FLOOR INSTITUTE

Designing engineers may address any manufacturer member listed in panel at right for HANDBOOK OF TRICKLING FILTER DESIGN—free

percent chlorine at a pressure of 10 psig, compressing it to 100 psig. The compressed gas is then cooled, first by water and finally by refrigeration to 5°F, is fed to a packed column where it flows countercurrently to carbon tetrachloride. The chlorine is stripped from the solvent in a column heated by a thermosyphon reboiler and is recovered as a solvent-free gas.

"Save That Valuable Chlorine." *Industrial and Engineering Chemistry*, April.

Cyanamid to Construct $4,500,000 Effluent Plant



GROUND has been broken by American Cyanamid Company for a $4,500,000 secondary sewage treatment plant to be erected on 58 acres of ground adjacent to the Bound Brook (N. J.) Works of its Organic Chemicals Division. When completed, the plant will be one of the largest biological industrial waste treatment plants in the world. It will treat the company's wastes before these enter the Raritan River, and will give secondary treatment to the domestic sewage from three neighboring municipalities—Somerville, Raritan and Bridgewater, which form the Somerset-Raritan Valley Sewerage Authority.

The Authority expects to begin construction this summer on an interceptor sewer and a primary treatment plant which will be built on 14 acres of land adjacent to the Cyanamid plant. Both plants are expected to be completed and in operation early in 1958.

Under terms of the contract which the Somerset-Raritan Valley Authority expects to sign in the near future with Cyanamid, the latter will treat the wastes of the Boroughs of Somerville, Raritan and Bridgewater Township in its new plant at a reasonable cost, after these wastes have been given primary treatment by the Authority. The agreement will provide that Cyanamid will charge the Authority only a proportionate share of the operating cost of the secondary plant. Cyanamid will bear the small financial cost of building slightly enlarged secondary facilities to handle the domestic flows from the Authority. The proposed agreement will be subject to review after a specified number of years when either party will be able to terminate it or agree to continue the arrangement.

The plant wastes at Bound Brook come from 800 different chemical operations in the plant in which the company uses and returns approximately 20,000,000 gallons of water to the river daily. More than three-quarters of a million dollars was spent by the company during this research period for equipment, operation and laboratory analytical work. Because of their complexity and because it was so important to the Raritan Valley area that the best treament plant be selected, it was necessary to build and operate many small and then larger pilot plants. At one time more than 20 persons were employed full time in running as many as 12 of these test units.

The activated sludge process was selected for treatment. When completed, the new plant will consist of six aeration tanks covering nearly four acres and having a total capacity of 20 million gallons; six final settling tanks; and complete facilities for laboratory and pilot plant work. Buildings will be of cinder block and stucco construction. All tanks will be made of concrete. It is expected that about 25 people will be needed to run the operation.

Whitman, Requardt & Associates of Baltimore, Maryland are design engineers for both Cyanamid and the Somerset Authority. V. E. Atkins is Division Manager for Cyanamid and F. L. Hess is chairman of Somerset-Raritan Valley Sewerage Authority. Construction of a substantial part of Cyanamid's new facility will be by John W. Ryan Construction Co. Inc., of New York City.

Duties and Headaches of a SMOKE INSPECTOR

FRANK J. REINHARDT, JR.,

Supervising Smoke Abatement Inspector, Division of Smoke Inspection, Metropolitan Boston Smoke District (In "Sanitalk")

THE ROUTINE duties of smoke inspectors of the Division of Smoke Inspection are prescribed by law. They consist primarily in visual observation of smoke emissions from stacks in the 31 municipalities comprising the Metropolitan Boston Smoke District, and the investigation of complaints. The smoke inspectors are usually assigned for the major portion of their time to certain specified vantage points, from which all of the domestic, commercial, and industrial stacks in a given area may be observed.

The inspector classifies and records Ringelmann chart standards of smoke according to density; times the durations of the emissions; makes in-plant investigations when necessary to determine the cause of emissions in excess of the prescribed legal standards, reporting his findings to the Supervising Smoke Inspector. He also serves orders and notices in connection with hearings held by the Division of Smoke Inspection, and testifies at such hearings and in court.

To execute their duties during in-plant investigations, inspectors must have a broad knowledge of fuels and combustion equipment and possess characteristics of resourcefulness and initiative. Although this training can be obtained in part by formal or self-education, to a great degree it is obtained primarily through years of experience. In the observation of visible smoke emissions from stacks, the inspectors must determine the class of stack (according to inside diameter) and the plant at which it is located, whether it be a domestic, commercial or industrial concern, or a ship.

Investigations sometimes reveal that the nuisance conditions complained of result from air pollutants outside the scope of the Smoke Law. Some of these special investigations are not only of a complicated nature but are frequently of

unique and special interest. A few of these that the writer recalls during his years of service with the Smoke District are here related.

A "white dog that turned black" incident occurred in 1953. Not only the dog, but houses and furnishings in one section of a city north of Boston were coated with a black substance, which analysis showed to be almost pure carbon. Subsequent investigation by the inspector revealed that a container of lampblack stored on the roof of a nearby industrial building had developed a leak. As a result a large quantity of finely divided carbon particles became airborne, later settling out over a two-block area.

During the spring of 1954, an inspector, acting on a complaint, examined an automobile in the Roxbury section. All horizontal surfaces of the vehicle bore a white coating, apparently chemically bonded with the original black finish. Its irate owner stated his intention of suing everybody in sight, including the Commonwealth. Investigation revealed that the paint spray collection system of a nearby factory was defective, with the result that paint spray booth effluents were escaping to the atmosphere and coating everything in the vicinity with a white, rime-like deposit. The remedy was obvious; and conditions were soon improved.

During a summer day in 1954, inspectors were alerted by complaints from women whose nylons were disintegrating. This "vanishing hose" incident occurred in the vicinity of Boston's South Station, when suddenly the ladies were engulfed by flurries of soot and gas. Several persons regularly in the area were interviewed; none of these people had noticed anything unusual. Inspection of numerous power and heating plants nearby showed all to be operating properly. Research revealed that similar incidents had occurred in other cities, and it was concluded that sulfur oxide mists from an unidentifiable source had reacted with the nylon material, resulting in its disintegration.

Inspectors were called out on several occasions between 1947 and 1954 to investigate a series of heavy sootfalls in Everett and Chelsea. In each case the condition occurred at night. The inspectors assigned to the investigation collected samples for analysis, checked wind direction and velocities and applied Stokes' Law (the law governing the settling of particles), interviewed residents and public officials in affected areas, and inspected all possible sources. It was never found possible to make a correlation of findings that would definitely indicate the point of origin of the "sootballs."

These are the more dramatic incidents in smoke abatement, but since we are all concerned with the air we breathe, it is also the day by day policing activities of our inspectors that keep offenders cautious and that protect the public. Whether it be plain smoke, soot, fly-ash, or, who knows, radioactive fallout in the future, our immediate duty and general purpose in the Department of Public Health is to keep the air clean and free from pollution.

Although most of the 300 complaints from the public handled annually by the Division of Smoke Inspection are quite routine, such interesting instances as the few cited above occur frequently. Because these nuisances do not fall within the jurisdiction of the laws, the Division was unable legally to take corrective steps regarding them. This emphasizes that the laws under which the smoke inspector operates are sometimes inadequate.

MUNICIPAL LOTS PROVIDE OFF STREET PARKING

Photographs courtesy Traffic Engineering Department, City of Coral Gables, Florida

RAPID EXPANSION of the resident population plus the influx of an estimated 40,000 visitors during the winter months has created many problems for the administrative and engineering officials of Coral Gables, Florida. Not the least of these has been the matter of providing ample parking spaces for the automobiles that crowd the city, particularly in the vicinity of the "Miracle Mile" shopping center.

Some years ago, in anticipation of greater parking demands, the city obtained an engineering survey of traffic and parking conditions. Later an Off Street Parking Board was appointed, and a number of new City-owned and privately constructed off-street parking lots have been provided. Details of this successful program are given in the article "Getting 10,000 Parking Spaces for Coral Gables," which appeared in the April, 1957, issue of PUBLIC WORKS.

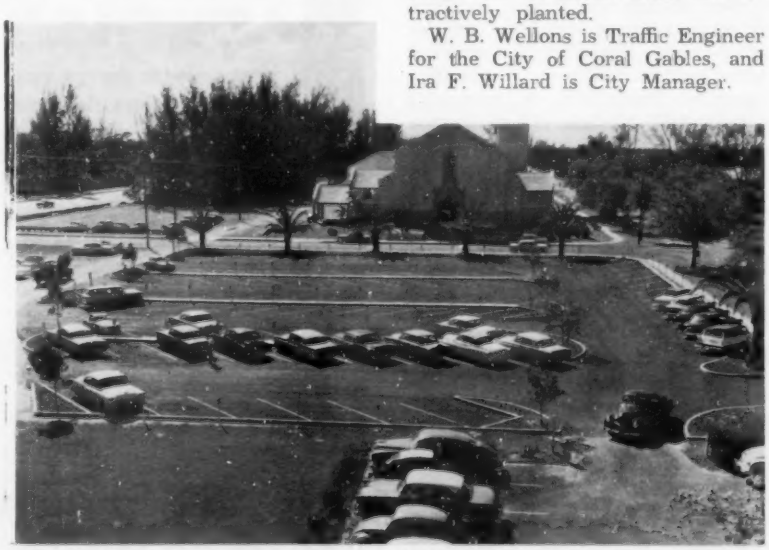
The accompanying photographs show several of the off-street parking facilities that are municipally owned. Most of the lots are located in the central business district or adjacent to the Miracle Mile shopping center. At the city-owned lots in these areas parking rates are 5¢ for 1½ hours, accumulative to 18 hours. These lots are in operation 24 hours a day, and are lighted during the dark hours. One of the lots shown, in a so-called "fringe" area, is located immediately in the rear of the City Hall. This lot is operated daily except Sundays and Holidays from 8 am to 6 pm. Here the rates are 5¢ for 2 hours; 10¢ for 4 hours; and 25¢ for 12 hours. No lighting facilities are provided at the present time, but proper conduit work and underground structures have been installed for future lighting when necessary.

Each of the lots shown was designed by the Engineering Department of the City of Coral Gables. Meters in these lots are Duncan Miller, Model No. 50. The lots are provided with permanent concrete curbs and all island areas are attractively planted.

W. B. Wellons is Traffic Engineer for the City of Coral Gables, and Ira F. Willard is City Manager.

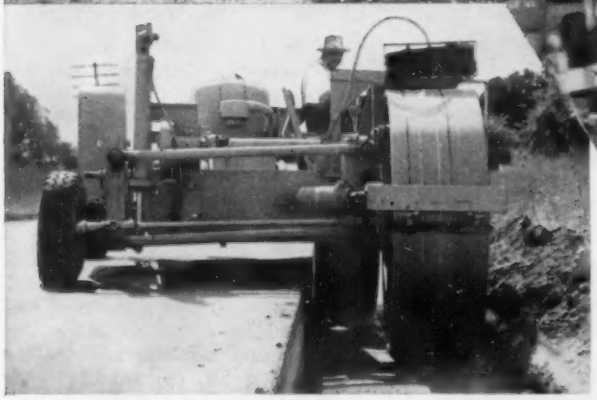
● PARKING lot adjoins Miracle Mile, provides readily available space for 98 cars.

● IN CENTRAL area, this lighted lot has 52-car capacity and is open all night.



● NEAR City Hall, this 94-car lot is open from 8 AM to 6 PM daily except Sunday.

How to make Road Widening a "Production Line" Job



Blaw-Knox Road Widener

- For Concrete—Paves from 18″ to 6′ widths and handles full output of dual drum concrete paver.
- For Bituminous Paving—Paves from 18″ to 10′ widths and handles up to 150 TPH.
- For Aggregate—Spreads from 18″ to 10′ widths and handles up to 200 TPH.

Blaw-Knox Trench Roller

- Hydraulically adjusts rolling width and depth while roller is in motion.
- Rolls wide to 39″ to save back-rolling. Reduces rolling time.
- Rolls narrow to 20″ giving dual compression.
- Works to a maximum depth of 24″ below existing pavement.

With Blaw-Knox Road Widener and Blaw-Knox Trench Roller on any road widening and shoulder building job you can be sure of production line speed and efficiency. This versatile team gives low cost, high speed production in all phases of work by reducing labor requirements, lowering equipment investment and saving materials.

The Road Widener works into all phases of the job—it can spread aggregate for base material and without change lay asphaltic concrete surface. It can place prepared subbase material for concrete widening and can be quickly rerigged with a special attachment to pave concrete surface. When working on a concrete job it can be equipped with a slip form in the correct length to meet state specifications—and a vibrating screed that sets up the concrete (spud vibrators can also be attached when desired). For asphalt or aggregate the strike-off gate is hydraulically controlled so it can be gradually widened when needed.

The Blaw-Knox Trench Roller can be used in all phases of aggregate and asphalt widening jobs. In the freshly dug trench it can provide the original compaction, then it can roll the base course material and finished asphalt surface.

For complete information about this high production team write to Blaw-Knox for Bulletin 2458R, describing the Road Widener, and 2497, describing the Trench Roller.

BLAW-KNOX

BLAW-KNOX COMPANY

Construction Equipment Division

43 Charleston Ave., Mattoon, Ill.

PUBLIC WORKS DIGESTS

THE HIGHWAY AND AIRPORT DIGEST

From Horses To Horsepower

Kinston, N. Carolina, was having parking problems and the merchants' business was falling off. A committee of merchants and councilmen came up with a workable joint venture to help solve the problem. Owners of property in suitable locations were to provide the property completely cleared, drained and black topped. The City agreed to purchase and install meters on a standard contract with 50 percent of revenue to the manufacturer and 50 percent to the land owner; the City providing collection and policing. The City becomes sole owner of the meters and after they are paid for, the property owner will receive 80 percent of collections and the City 20 percent. Income from each of the 448 street meters averages $5.20 per month and receipts for the first month from the first metered lot averaged $7.50 per meter. Lots are equipped with Duncan meters which take nickels, dimes and quarters. Timing is set for 1 and ½ hours for five cents and the meters register up to ten hours so that all day parkers can be taken care of. One problem that arises is that leases run for only 2 years on the lots, whereas they should run for at least ten years.

"From Horses to Horsepower—Where to Hitch is Still the Question." By R. R. Robinson, City Manager, Kinston, N. C. PUBLIC WORKS, May.

Promoting a City-Wide Street Improvement Program

The Kiwanis Club along with the other service clubs of Great Falls, Mont., sold the people on the idea of having all the streets in the city paved. The project passed the city council; assessments are to be spread over 15 years and the maximum estimated assessment for a lot 50 by 150 ft. is $615. Four contractors submitted a combined bid of $4,186,721 for the project. The city was divided into three north-south sections and one contractor took the eastern third, two the central section and one the western third. Plans provided that each street would have new or repaired curbing with 6 inches exposed; residential streets would be built up with 4½ inches of sand, 5 inches of sandstone gravel and 2 inches of asphaltic concrete; arterial streets received 5 inches of sand, 8 inches of gravel, and 3 inches of asphaltic concrete. Some of the equipment used in the reconstruction included Cat DW10 scrapers, Cat D8 tractors, Cat No. 12 motor graders, Buffalo-Springfield Kompactor, Ferguson rubber-tired roller, Gradall, Cat No. 977 and an HTV traxcavator, AC HD20 shovel, Tampo roller and Hyster Grid-Roller.

"Promoting A City-Wide Street Improvement Program." PUBLIC WORKS, May.

Steel Protects Curbs From Traffic Damage

New York City is placing steel curb facing in heavy traffic areas. The "double bulb" curb is 9 ins. high and weighs 15.5 lbs. per lineal ft. New York uses 20-ft. sections, but they can be rolled any length. The curbing can be set at the rate of about 350 feet per day. Large radii curbing are readily curved on the job and shorter radii are formed at fabricating shops. Steel anchors butt-welded to the back face of the curbing fasten it to the concrete back-up. Expansion joints are provided between 20-ft. sections of straight curbing. Sections are welded both at the top bulb and along the face of the section on radii and at joints between radius curbing and straight lengths.

"Steel Protects Curbs From Traffic Damage." *American City*, April.

Electronic Computers Aid Surveying Calculations

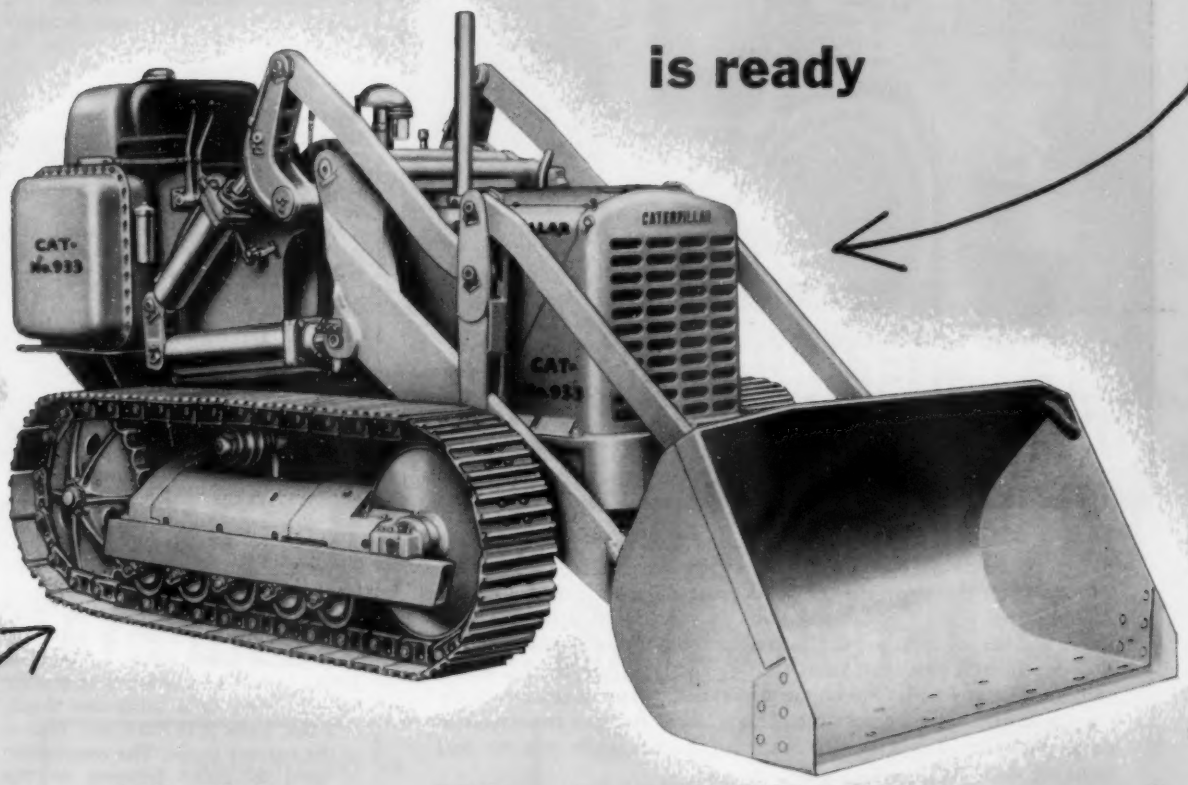
A review of the development of electronic computers for solving problems in the surveying and civil engineering field is covered. Bendix Computer has worked, or is now working, on the following types of problems, to name a few: 1. A program has been written that will accept either conventional field notes, or x, y, and z co-ordinates as scaled from contour maps or taken as points from stereoplotting devices and can compute the cut, the sum of the cut, the fill, the sum of the fill, the net, the sum of the net, the right and left points of intersect, expressed as co-ordinates from the center line; 2. A traverse closure problem has been programmed; 3. Traffic simulation

● **CONCRETE pavement 9 ins. thick, after being broken, is being removed with a Gradall. Reinforcing was ripped out by the machine. Rate of work was 500 ft./day.**

ANNOUNCEMENT! The new, improved

No. 933 (Series E) TRAXCAVATOR*

is ready



with longer life, lower maintenance!

Looks a lot like the popular No. 933 you already know—but there's greater stability, performance and durability built into this new Series E!

Now the rugged CAT* No. 933 Traxcavator includes a new heavy-duty undercarriage with:

- New Rugged Track Roller Frame
- New Solid Sprockets
- New Heavier Idlers
- New Tough Track Rollers

The complete line of Cat-built Traxcavators	No. 977	No. 955	New No. 933 (Series E)
Flywheel HP at sea level	100	70	50
Bucket capacity, cu. yd.	2¼	1½	1
Bucket tip-back at ground level	40°	40°	40°
Bucket tip-back at maximum lift	46½°	47½°	48°
Dumping height (center of hinge pin to ground)	141½"	128"	119 1/16"

The easy operation, the great capacity and the dependable power—these features remain as outstanding as before.

For complete details on this *tough* new Traxcavator, call your Caterpillar Dealer. He'll be glad to give you full information on the complete line of Cat-built Traxcavators. He's the man to remember, too, for expert service and for replacement parts you can trust.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

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ONE GOAL: To concentrate our capabilities, resources and experience on the design, manufacture, distribution and service of job-tested heavy equipment.

problems are being done; 4. Statistical studies have been made correlating accident rates with the type of signs and symbols for certain critical areas; 5. Studies are under way on drainage problems as well as sewage disposal problems; 6. The calculation of stresses, particularly for indeterminate structures, in bridge design; 7. Origin and destination surveys have been made. A very good 7-step program for the design of new highways was outlined by Lockwood, Kessler & Bartlett of New York in the article.

"How Electronic Computers Aid Surveying Calculations." By V. A. Van Praag, Bendix Computer Division. *Street Engineering*, April.

Road Department Stabilizes With Salt

Conesus, N. Y., has stabilized 6½ miles of gravel road with rock salt in the last 6 years. The following equipment is used to stabilize the roads: Grader with one 9-ft. and one 30-in. blade and a scarifier; an old road maintainer with two blades and two rakes which is pulled by the grader; dump truck with a capacity of 8 tons; a rotary salt spreader; and a steel wheel roller. Bank-run gravel with a good quantity of small stones, sand and just enough clay to act as a binder is available when needed. The first action to build the road is to scarify the old road to a minimum depth of 3 ins. Then it is filled and bladed to the correct grade. The maintainer is used to make furrows so the rock salt will stay in place when mixed. The salt is spread with a rotary spreader at the rate of 12 tons per mile. The salt is then mixed with the aggregate by passing the rakes over the surface one or two times. All during the raking and salt-spreading operations, traffic is kept off the road. The traffic is allowed to resume when the salt has been raked, and the trucks and cars using it act as pneumatic rollers. If the mixture has a fair amount of moisture in it, from previous rains, or if it is raining at the time the salt is mixed, the steel-wheel roller is used for final compacting.

"Town Road Department Stabilizes with Salt." By Edward Newcomb, Highway Supt., Conesus, N. Y. *Constructioneer*, April 15.

Keeping Signs and Parking Meters in Top Shape

Atlanta, Ga., has a "U" shaped building, with a long central stem and end wings, that houses the parking meter and sign sections,

POWERFUL REASONS WHY A CHEVROLET STAYS ON THE JOB...SAVES ON THE JOB!

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(weighs up to 150 lbs. less than others)

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- Rugged yet light crankshaft
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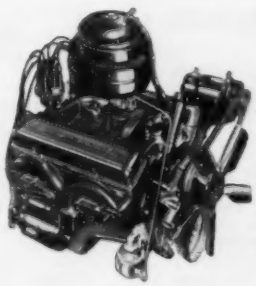

Chevrolet trucks are powered by V8's that make every ounce count. Because of their trimmed-down design, they use less power to haul their own weight and put more power into hustling your cargoes. Like all Chevrolet truck components, these engines are efficient performers—and that means top economy and dependability!

Chevy's the dollar saver *de luxe* of the American road, and many of the reasons why can be found beneath the Chevrolet truck hood. That's where you'll often find a great V8 that's at the head of its class for compact, *efficient* short-stroke design. You won't find features to equal all those listed here (at left) in any other truck V8's today. Or, if you prefer a 6, Chevy's got the most popular 6-cylinder powerplants in the history of hauling. They're honest-to-goodness *truck* engines, specially built to *stay* and *save* on rough, tough hauling jobs.

You'll find that a Chevrolet truck gives you *so much* to save with! Your Chevrolet dealer is waiting to fill you in on all the facts. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

Biggest sellers . . . because they're biggest savers! CHEVROLET

CHEVROLET TASK·FORCE 57 TRUCKS

carpenter and paint shops, and service functions. There are seven service men, patrolling the seven territories into which the city is divided, who inspect 3354 meters on the street. For each man there is a complete book, with an index listing every meter by number and its location. On the street map, arrows show the man's course to cover. The average per man is about 500 meters a day. He walks the entire course every day in a five-day week, tests every meter, and makes a report on it. A faulty meter is brought back to the shop at the end of the day and is repaired and adjusted in the afternoon. The Sign Mfg. Division makes between 4,000 and 5,000 signs each year. The department buys aluminum blanks in 11 different shapes and sizes. Scotchlite sheeting is placed by a vacuum with the applicator taking blanks up to 6 by 4 ft. Six crews work out of the sign shop. Two are on truck mounted equipment for marking lines on the streets; the other four crews do all other work on the streets in connection with marking, such as erecting and maintaining signs, painting yellow curbs and parking space lines, and other miscellaneous jobs. When the weather is bad, the crews work in the sign shop. Red letters on white or silver background are used on many signs, and other colors are used for a wide variety of purposes.

"Keeping Signs and Parking Meters in Top Shape." By Guy Browning Arthur. PUBLIC WORKS, May.

Highway Signs for the Interstate System

Highway marking with directional signs is an art that has grown with the evolution of automotive travel. The concept of a large volume of traffic moving rapidly over great distances on broad, limited-access highways introduces new problems in the adequate marking of highways. By reason of the proposed design standards, there will be a minimum need for caution and warning signs, and no need for stop signs and railroad crossing signs. The need is for directional, informational, and service signs. All the state highway departments have been asked to submit suggested marker designs for the system to the AASHO. The AASHO has assigned the working out of all recommended expressway signing to its Committee on Traffic. The group is studying signing practice on existing toll turnpikes and expressway facilities operated by the state highway departments, and is also working closely with the Joint Committee on Uniform Traffic Control Devices. A uniform signing practice will be in effect and in use by late fall of this year.

"Highway Signs for the Interstate System." By A. E. Johnson, Executive Secretary, AASHO. *Civil Engineering,* April.

Prestressed Bridges Installed on Parkway

A total of 355 prestressed concrete beams were cast, ranging in length from 24 to 72 feet, for the bridges on the 9.5-mile extension of the Garden State Parkway. Seven-strand 3/8-in. high tensile steel wire was used for the entire operation. The forms used for concreting were made of steel plate and 30-ft. sections were erected as a continuous unit. The concrete was poured by a team of ready-mix trucks. One truck poured the bottom of a beam while the other followed closely and poured the top. Two internal vibrators worked with the trucks. Before the wires could be detensioned, the concrete had to reach 4000 psi. A 28-day test of the concrete had to reach a minimum of 5000 psi. Curing was done by steam produced

Polselli & Angelucci use Heltzel Flexible Radius Forms in pouring a sharp curve in the driveway section of Abington School in a Phila-

by a 125-hp steam boiler because the work was done in the winter time. After the curing operation, the wires were detensioned, and the strands from between each member were burned off with an acetylene torch. The beams were taken to the erection site by Ross carriers.

"Prestressed Bridges installed on Garden State Parkway." *Constructioneer*, April 1.

Grade Separations in Fort Wayne

The Nickel Plate Railroad has completed a grade elimination project in conjunction with the City of Fort Wayne, Allen County and the State of Indiana. To reduce property damage to a minimum, the two main railroad tracks were elevated 17 feet, and although the elevation consists mostly of embankment, for economic reasons, the structure through the business area of the city is concrete pier and steel beam construction. This structure is 1970 feet long and consists of 44 beam spans with ballasted concrete deck. To obtain uniform bridges, 3-span (50-70-50-ft. spans) continuous beam bridges for 3 streets were built. Through girder spans over 3 other streets and a 3-span ½-through-girder bridge provided for two dual highways. All of the openings were 14-ft. under-clearance. The cost of the project was approximately $7,500,000. The concrete piers for the structures are supported by approximately 30,000 feet of 12 3/4-in. OD 0.250-in. Armco wall piling.

"Grade Separations in Fort Wayne." By R. T. Blewitt, Bridge Engineer, New York, Chicago & St. Louis Railroad. *Municipal Construction*, March.

Low-Cost Farm Roads Being Reclaimed

The Texas State Highway Dept. and its Land Service Road Division are utilizing new roadbuilding techniques on local feeder roads into the rural areas not served by the trunk highway system. The roads are designed to handle a traffic volume of 200 or more vehicles per day. Several projects are discussed with design and construction procedures fully explained. Wet and saturated areas were stabilized with lime. The wet material was excavated to a depth of 4 or 5 ft. and spread out along the roadway while lime was added to the soil. Lifts of the wet material were added and sheepsfoot rollers were used to knead and mix the soil and lime. The lime absorbed much of the excess water and the soil became

Polselli & Angelucci use Heltzel Flexible Radius Forms in pouring a sharp curve in the driveway section of Abington School in a Philadelphia suburb.

For more gentle radius curbs, Heltzel Straight Curb Forms were used. Abington School required approximately two miles of curbing.

"For my money, I'll take HELTZEL FORMS ...everytime!"

SAYS LEADING PHILADELPHIA CONTRACTOR

"I've used them all, and I'll say Heltzel builds the best line of forms I know of," says George Angelucci, partner of Polselli & Angelucci, one of Philadelphia's best known curbing contractors.

"My form setting crew can set a third again as many Heltzel Forms as other makes," continues Mr. Angelucci. "What's more, Heltzel engineers know the industry, and design their forms to the contractor's advantage. There's no form bowing because the stake pockets are placed in just the right spots to give the form maximum strength and rigidity."

If you haven't as yet tried Heltzel Forms, why not take the advice of leading contractors—like Polselli & Angelucci—and use the one outstanding form available today. Heltzel builds a complete line of steel forms for any concrete job — straight curb, radius curb, curb and gutter of any description, sidewalk, driveways, foundations, piling, island, etc. Next time — specify "Forms by Heltzel" — for almost half a century America's leading form manufacturer.

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George Angelucci checks form alignment as pouring goes on behind him.

stabilized. On many of the jobs, Uvalde rock asphalt is used instead of pea gravel for road surfacing. When the rock asphalt is used for surfacing, the applications of liquid asphalt are reduced to 0.12 gal. psy for the first course and 0.15 gal. for the second course. The aggregate is applied at a rate of one cu. yd. to 40 sq. yds. for the first application of 5/8-in. aggregate. The second course of 3/8-in. material is put down at a rate of one cu. yd. to 100 sq. yds.

"New Techniques Help Reclaim Low-Cost Farm Roads." *Contractors and Engineers*, April.

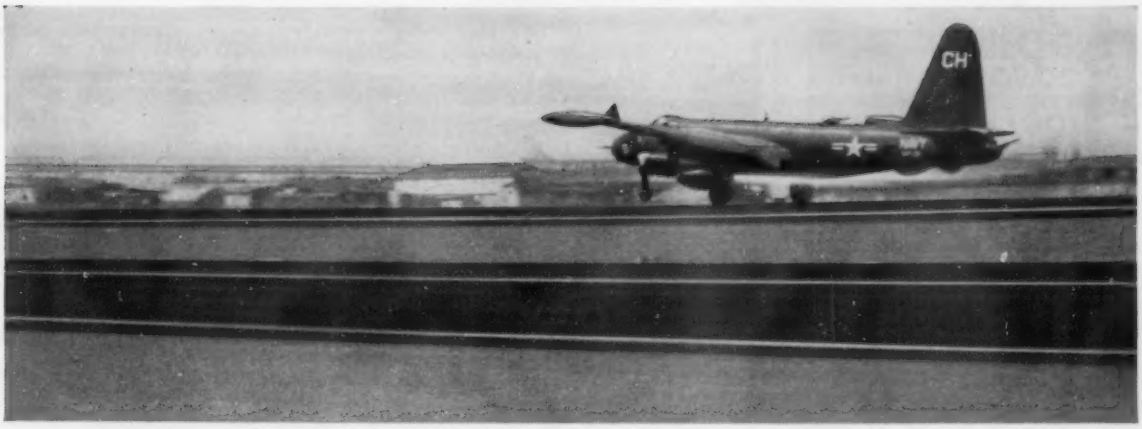
Surface Treatments for Highways

Two very essential functions of a surfacing can be accomplished with the surface treatment: (1) a waterproof layer; and (2) a non-skid surface with adequate resistance to traffic abrasion. Under single treatments and seal coats, aggregate characteristics, aggregate quantity, average mat thickness, bitumen and quantity of bitumen are fully covered. Successful surface treatments require proper types and quantities of bitumen covered with hard, durable, properly graded aggregates applied in the proper quantities. Construction details include preparation of surface, applying bitumen, application of aggregate, rolling, removing excess aggregate and consideration of weather conditions. On mulitiple surface treatments, it is essential that each succeeding aggregate layer mesh with the layer previously placed so that the completed construction will form a compact mass with a dense, tight surface. Construction procedures for multiple surface treatments are essentially the same as those for single surface treatments except that the process is repeated either two or three times.

"Surface Treatments for Highways," by Fred J. Benson, Executive Officer, Texas Transportation Institute, and Vice Director, Texas Engineering Experiment Station. PUBLIC WORKS, May.

County Tackles Its Engineering Problem

Engineering personnel is not to be had even though the starting salary for a graduate engineer is $5200 a year and he may retire at the age of 60 with 30 years of service at 57.5 percent of the highest 3-year salary, in Contra Costa County, Calif. The public-works department has struggled with the problem of an engineering shortage actively since 1952, when a $10,250,000 road-bond issue was approved and this construction program was added to the department's normal $1,000,000 or more annual construction appropriation. Construction inspectors have been hired and work under a resident engineer who is either a professional civil engineer or an engineer-in-training. Technically trained men are used to run the survey parties entirely rather than professional or college-trained men. With the federal highway building program, more qualified engineers will be needed and an engineering efficiency committee, composed of four professional engineers was organized to cope with this new problem. The committee was divided into two teams: one team is concerned with new methods of operation, technological advances and the introduction of other new ideas; the second team deals with re-analyzing and re-evaluating the present organization, personnel and operations. The first team is working on the desirability of using electronic computers, the use of photogrammetry and simplifying measurement of quantities on contracts and of having construction surveys done by contractors. The second team has



Navy gets double savings with Bitumuls Slurry Sealing of Runways at Jet Training Station

ONE of the busiest military air installations on the entire West Coast is the Alameda Naval Air Station. In addition to heavy traffic in propeller-driven aircraft, Alameda is an important West Coast jet aircraft training center.

Runway Construction—The runways of this Naval Air Station are surfaced with asphaltic concrete, placed over a 6" course of Bitumuls Sand Mix. The wide shoulders adjacent to these runways are also Bitumuls RS-1 Chip Seal. The surfacing was placed some four years ago, and recently showed signs of weathering. Close

Bitumuls Slurry is chuted into spreader-box as mix-truck travels at speeds up to 5 MPH.

inspection disclosed some ravelling; minor hair-cracks on the surface; and some loose material. This loose material, while of little importance during the days of conventional-type aircraft, had become a major source of expense after jets started operating here. Sand, small stones, and other loose material can cause considerable damage, when scooped into the jet engines.

A Dual Problem—The Navy was looking for answers to two problems: First, a method of revitalizing the runways and extending the life of the pavement surface. Second, a means of cutting down the repair bills involved when jet engines were damaged by loose material scooped up from the surface of the runways. *They found a single answer to both these problems in Bitumuls Slurry Seal!*

Bitumuls Slurry Seal composed of fine, sharp aggregate, Bitumuls Mixing Grade emulsified asphalt and water, was mixed in transit-mix trucks to a free-flowing, slurry consistency. It was applied by the squeegee action of a spreader-box to 350,000 sq. yards of runway and taxi-way. Contract for this work was awarded to George Reed, a contractor from Modesto, California.

To offset the high abrasive action of the aircraft tires on landing, a dilute (3 to 1) Bitumuls tack coat was placed ahead of the Slurry Seal to insure maximum adhesion.

Fast-Fast Application—It was "business-as-usual" at the Air Station while this work was in progress. In spite of the additional requirement of the tack coat, Bitumuls Slurry Sealing reduced interference with air traffic to a minimum. Planes at the Station were able to taxi over the fresh seal coat four hours after application. Jet aircraft landed on the new seal 24 hours after application.

The costs involved in providing this new life for the existing runway pavement was considerably less than that of a normal seal coat application.

"Meanwhile, at the Hangar..." In the repair shops, an extra "bonus" economy will be realized because Bitumuls Slurry Seal has eliminated loose material from the runways. *The cost of mechanical repairs occasioned by the induction of foreign material through the jet engines is expected to be sharply reduced.*

A Proved Procedure—Bitumuls® Slurry Seal has been proved on many installations—on highways, streets and airport runways—in terms of economy of initial application, and also in terms of durability. It can be applied in any quantity or volume for either construction or maintenance. Call our nearest office if you need additional information. It will be given gladly; and, of course, without obligation.

Dodson's Digest

How to eliminate dusty roads

Steve Harper called me up for a golf game the other day. Steve's job as a county road commissioner keeps him pretty busy, but he likes to get in a round of golf whenever he can.

"It feels good to get away from the office," Steve confided after we teed off. "My phone's been ringing all morning with complaints about dusty roads. I'm paving them as fast as I can, but everybody wants his road paved next."

"Wait a minute," I said. "Aren't you treating those unpaved roads with Calcium Chloride to keep the dust down?"

"I used to, Dod," Steve replied. "But now we've got all our money tied up in this paving program, and . . . "

"The Calcium Chloride road should be *included* in your paving program," I broke in. "It'll get rid of your dust problems. And maintenance with Calcium Chloride and aggregates provides a better base for future hard surfacing."

"But what about the money?" Steve wanted to know.

"Look," I explained. "Let's say you're paving 50 miles of road this year. Cut five miles from that, and you'll have enough money to treat 50 additional miles with Calcium Chloride . . . mileage you'll be getting ready for next year. That will give you 95 miles of smooth, dustfree roads, and your paving program will still be going strong."

"Makes good sense to me," Steve said. "Let's speed up this game so I can get started on it this afternoon." He demonstrated this last point by neatly dropping a 15-footer for his par three.

Just then a ball appeared out of nowhere, and rolled to a stop two inches from the hole. In a playful mood, Steve tapped it in. "I've always wanted to see a golfer's face when he gets a hole-in-one," he winked at me.

We stuck around to watch, and pretty soon a man climbed up the hill to the green. He looked in the cup, and his face lit up. "Hey, Joe," he shouted back to his still invisible partner, "I sank it for an eight!"

—L. D. Dodson

P.S. — For valuable tips on how to solve *your* dust problems with Wyandotte Calcium Chloride, write me for your free copy of our leaflet, "How To Stop Bothersome Dust." *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.*

worked on the project of finding out whether engineers are still doing work that can be done by technically trained personnel. It has found that 20 less engineers are needed and this represents a potential saving of engineers of nearly 40 percent.

"County Tackles Its Engineering Problem." By Benjamin O. Russell, Administrative Assistant, Contra Costa County. *Better Roads*, April.

Other Articles

"Mobile's 'Private Fort Knox' Finances **86-mile Paving Program.**" Seven projects are under way in Mobile, Alabama, which will provide curb-and-gutter and soil-cement base with asphalt surface on every unpaved street. Street Engineering, April.

"Albuquerque **Modernizes** Street Signs." By Francis C. Burton, Traffic Engineer. Street Engineering, April.

"Flexible Fin Eases **Rush-Hour** Expressway Jam. By William J. Mortimer, Supt. of Cook County (Illinois) Highway Dept. Street Engineering, April.

"Today's **Street Maintenance** at Yesterday's Prices." By Carl E. Neill, Staff Engineer, American Bitumuls & Asphalt Co. Public Works, May.

"America's **Covered Bridges.**" By Richard Sanders Allen. Consulting Engineer, April.

"The A.10 Will Be used to Find the **Best Concrete Base.**" Municipal Engineering, April 5.

"Litter and Street Cleaning." The author diagnoses the causes of the **litter problem** and suggests a cure. By Geoffrey Taylor. Contractors Road and Municipal Engineering, April 3.

"**Concrete Versus Flexible** Methods of Road Construction." By W. E. I. Armstrong. Contractors Record and Municipal Engineering, March 20.

"**Financial Planning** for an Expanded Highway Program," by the Division of Financial and Administrative Research Bureau of Public Roads. By G. P. St. Clair, Chief of Division and Thomas R. Todd, Transportation Economist. Public Roads, April.

"Electric Computers Speed up Bridge Design." Several types of **bridge design problems** are solved and the future possibilities of the computers are discussed. By John J. Koziak, Senior Bridge Engineer and Robert E. Shields, Associate Bridge Engineer, California Division of Highways. Civil Engineering, April.

"Central Mix 'Worked out Fine' for Cement-Treated Base Job." **Close control of cement,** moisture and mixing attained through use of pugmill type central plant for freeway project near Spokane, Wash. By H. K. Glidden. Roads and Streets, April.

"Cutting Concrete with Diamond and Abrasive Blades." The methods of **concrete joint cutting** are fully explained and the new cutting tools that are available on today's market are described. By J. H. Denton, Product Engineer and J. I. Jenkinson, Abrasive Engineer, The Carborundum Co. Roads and Streets, April.

"Illinois Plans Wider Use of Precast **Prestressed Bridges.**" V. M. Romine, Engineer of Bridges and Traffic Structures, Illinois Highway Dept. Better Roads, April.

"**Developments** in Concrete Road Technique." By W. P. Andrews. Contractors Record and Municipal Engineering, April 10.

• • •

Treatment Efficiency Study

(*Continued from page* 114)

the Spiraflo clarifiers. The results of these tests are tabulated in Table 4.

A series of quiescent tests previously had been made on a 50-ft. dia. by 9-ft. side water depth Spiraflo at another plant which treats a combination of domestic sewage and a heavy industrial waste. Based on an average theoretical detention time of 2.09 hours in the clarifier and 438 ppm suspended solids in the raw sewage, the average removal of suspended solids in the quiescent tank was 267 ppm or 61 percent, and exactly the same removal in the Spiraflo. For the same detention times and a raw BOD of 442 ppm,

Table 4—Quiescent Settling vs. Continuous Operation

(Grab Samples)

	pH	Total Solids	Dissolved Solids	Susp. Solids	Percent Reduction of Susp. Solids
PRIMARY CLARIFIER TEST NO. 1					
Raw Sewage	7.2	676	516	160	...
Clarifier Effl.	7.1	800	640	160	0
Quiescent Effl.	7.2	650	498	152	5.0
PRIMARY CLARIFIER TEST NO. 2					
Raw Sewage	7.4	1108	768	340	...
Clarifier Effl.	7.0	758	598	160	52.9
Quiescent Effl.	7.4	957	731	226	33.5
INTERMEDIATE CLARIFIER					
Raw Sewage	7.2	572	462	110	...
Clarifier Effl.	7.2	565	497	68	38.1
Quiescent Effl.	7.2	544	477	67	39.0

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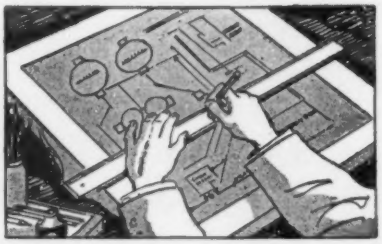

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468 Fourth Ave., New York 16, N.Y.

the quiescent tank removed 152 ppm or 34.4 percent while the Spiraflo removed 156 ppm or 36.3 percent of the BOD.

It is apparent that a series rather than one or two quiescent tests, is desirable, when industrial wastes are involved, because the quality of the sewage can change rapidly, especially in the case of high concentrations of non-settleable suspended solids and BOD as is common with milk wastes, such as at Cumberland.

It should be remembered that the detention in a clarifier is never as long as in the quiescent tank. Spiraflo clarifiers with a 9-ft. swd or more will normally provide actual detentions of from 60 to 75 percent of the theoretical. Measured to the skirt bottom, the actual detention will run from 70 to 85 percent of the theoretical. The 26-ft. dia. intermediate Spiraflo at Cumberland with a skirt depth of 9 ft. 4 ins. provides a theoretical detention of 1.53 hrs., a surface rate of 1100 gallons and a weir rate of 8080 gallons per ft. per 24 hrs., based on the volume above the bottom of the skirt and at an average combined flow of 290,880 gallons in a 12-hr. period.

Conclusions

The data presented shows that the plant is doing an excellent job. At the time of the tests, the physical condition of the plant was good. The receiving body of water, Beaver Dam Lake, had more color in it than the plant effluent. The visibility in the final clarifier was a minimum of 4 ft. below the water surface. Fish had reportedly been living in the final tank prior to these tests.

Apparently the BOD reduction by the primary Spiraflo is related to the reduction of settleable solids rather than to the removal of suspended solids. This is to be anticipated in sewage containing large amounts of dairy wastes. Periodically the combined waste flowing into the primary was white with cheese plant waste.

The decrease in the pH content between the primary influent and effluent can be explained only by the milk solids turning septic. While the primary was designed for a short detention, the raw sewage flow was such as to give an average detention in excess of 3 hours, when the volume of the tank is measured to the bottom of the skirt. The designed detention could have been maintained by returning the sludge and scum from the intermediate and final clarifiers to the primary clarifier.

The sloughing of the tile media in

the first stage is apparent in the intermediate clarifier results. A rapid drop in the air temperature on the 27th no doubt caused the lightly loaded second stage filter to start to unload.

Quiescent testing of a sewage prior to designing a plant could be of assistance in deciding what can be accomplished by primary treatment or by secondary treatment, and in determining what percent of the treatment should be placed in the secondary portion of the plant. This is especially true when trade wastes are involved.

After a plant has been built, quiescent testing should reveal the efficiency of a clarifier.

• • •

Electronic Computation of Photogrammetric Data

(*Continued from page* 116)

matical and physical process, and the results to be expected will be in accordance with the quality of the equipment and basic data used, the height of the aerial camera above ground and the skill and judgment of the photogrammetrist.

For the owner and the contractor to have mutual confidence in the accuracy of the map and of the aerial photographs from which the cross sections and earthwork quantities are to be derived, the most authoritative standards recommend that the aerial camera be no higher above ground than 1,000 times the contour interval, and that the enlargement from aerial photo to final map be in the neighborhood of 5 times or less. This ratio should yield a map in which 85 percent of the contours will be correct to within one-half the contour interval; and none, provided the ground is visible, will be in error by more than the contour interval. In every highway project a baseline is required at some stage of design or construction. We recommend that it be laid in the field during the photo mapping stage so that it will serve to strengthen the map. This costs no more and spreads the baseline's utility over the entire life of the project. The baseline should closely follow the proposed general alinement for maximum utility. For very little extra expense a profile can be taken along the baseline, and this will further strengthen the accuracy of the map. Each pair of photos should have four vertical control points set near the corners of the model.

Cross sections taken by spot ele-

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ATLANTA

WATER SUPPLY, SEWAGE DISPOSAL, INCINERATORS, POWER PLANTS

vations in a first order stereo plotting instrument should yield results correct to within 0.3 of a foot in elevation, if the photos were taken from 2,000 feet. While admittedly this is not as correct as a single ground survey reading, the greater number of points taken, the better selection of cross sections based upon contours of the whole ground, and the uniformity of results over the whole cross section, make the method promising for use in computing pay quantities. If this is accepted for computing preliminary quantities there is, of course, no reason why it should not also be accepted for final sections. It can readily be done by rephotographing the completed project, establishing a little more ground control, and taking the cross-section in the stereo instrument.

Accuracy Tests

We have run some tests on a short section of highway in Long Island. This is a major project, the Long Island Expressway and the width of the right-of-way and lay-out will be comparable to much of the Interstate System. The test section is only 4,000 feet long, and in relatively minor relief. Our tests include ground cross sections, cross sections interpolated from the 2-foot contour map, cross sections by A-5 spot elevations, and cross sections by Kelsh plotter spot elevations. We computed the quantities both by Bendix G-15 and planimeter. The cross sections were plotted in distinctive colors on profile paper for comparison.

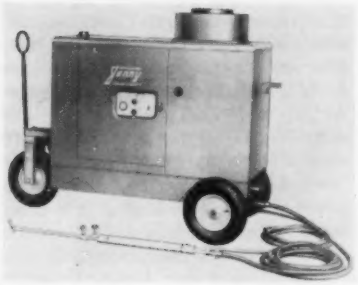
There is very close agreement among the colored lines which are the photogrammetric sections. The black lines, the field cross section in general, fall right in with the other three. But there are also instances where the black line leaves the others by two or more feet. We looked into some of the discrepancies by recross-sectioning, and found them to be field survey errors, and the correct elevations were found to fall within the photogrammetric values.

Comparative quantities in this sort of light grading were by field measurement, 134,800 cubic yards; and by A-5 spot elevations, 138,900 cubic yards, a difference of 3 percent. It is impossible to say which is closest to the absolute value.

This paper, slightly condensed here, was presented at the meeting of the AASHO Committee on the Use of Radio in Highway Departments at Atlantic City on November 29, 1956.

PUBLIC WORKS EQUIPMENT NEWS

Steam Cleaner For Construction Equipment



Shown above is the Model "1858" Hypressure Jenny cleaner by Homestead

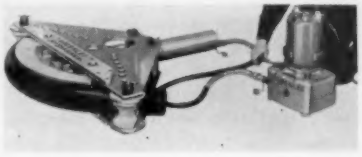
Finger-tip control of flushing and rinsing capacities up to 480 gallons per hour is a feature of the Model "1858" Hypressure Jenny, announced by Homestead Valve. Known as Series "1800", this line of steam cleaners has ample capacity for removing dirt and grease from industrial machinery, material handling and construction equipment, trucks, tractors and parts. Designed especially for production line and extra-heavy duty cleaning, and for either single gun or two-gun operation, the series offers a choice of oil-fired or gas-fired units in stationary, portable, or trailer mounted types. In places where electric current is not available, units are offered with gasoline engine drive. For more information write Homestead Valve Mfg. Co., Coraopolis, Pa., or circle **No. 6-1** on the reply card.

Indexing System Codes Directly on Film

An index coding produced directly on 16mm microfilm is announced by Recordak Corp. Kodamatic indexing is produced by two lines exposed in between the document images. As the film is advanced through a constant-focus film reader the lines change position either laterally or vertically as predetermined by the index coding. In combination, these lines can be exposed in 99 different code positions. The indexing is read while the film is moving. The position of each code line on the film is established by two control dials, located alongside the feeding throat on the front of the microfilmer. Each dial is numbered from 0 to 9. When set at specific numbers, the dials activate tiny lights which expose the code on the film. Alphabetical scales are also available for the control dials. For further details write Recordak Corp., 415 Madison Ave., New York 17, N. Y., or circle **No. 6-2** on the reply card.

Lightweight Power Bender For Pipe

A new lightweight hydraulic bender that will make a full 90° bend in 4-in. and smaller conduit and pipe with one ram stroke has been announced by Greenlee Tool Co. Specially designed pipe supports serve as rollers when moving from one location to another. Due to its unique design this bender can be used in any position without loss of operating efficiency. Easy, fast removal of pipe supports means quick insertion and removal of pipe from the front of bender with the frame always remaining in one piece. Regularly operated with the No. 798AC-SA power pump, and connected by a quick-coupling high-pressure hose, the No. 884 will bend 4-in. pipe 90° in 4 minutes. If higher bending speed is desired the No. 797E-SA power pump will do the job in only 30 seconds. Any other high-pressure power pump of up to 10,000 psi can be used with this bender. For added versatility the bender can be used with other Greenlee attachments for bending thin-wall conduit, tubing, and busbar. Complete details from Greenlee Tool Co., Rockford, Ill., or circle **No. 6-3** on the reply card.



Traffic Line Remover

Unit is also used for blast cleaning

A new traffic line remover, the Cyclone, has been announced by Cyclone Sandblast Equipment. One man is in entire control of the operation and the unit is very mobile. When used in traffic, the sand does not fly from the machine to such an extent as to obscure driving vision; pedestrians are not bothered. For full details write Cyclone Sandblast Equipment, 42 Clara St., San Francisco, Calif. or circle **No. 6-4.**

Self-Priming Diaphragm Pumps

Rice diaphragm pumps are equipped with large swing type wide opening valves with replaceable neoprene facings that seat against self-cleaning and replaceable valve seats. They will handle water from slow seepage to full capacity; also will handle water with a high percentage of mud, sand or other foreign materials. Closed discharge will pump up to 25-ft. heads. Cut tooth speed reducers operate in oil in a totally enclosed case, thus excluding dirt, water or other extraneous materials. For more information write to Rice Pump & Machine Co., Belgium, Wisc., or circle **No. 6-5** on the reply card.

Barber-Greene 879-"B" finisher offers greater horsepower

Six new models of the International A-line are shown above

Barber-Greene Crawler Mounted Finisher

A new crawler mounted asphalt paver which embodies four new improvements, giving it faster laying speed, faster travel, lower maintenance cost and increased power, has been announced by Barber-Greene. These major improvements are: 1) A new transmission which provides both higher operating and travel speeds. The maximum operating speed has been increased to 64 ft. per minute and the travel speed to 3¾ miles per hour; 2) A new high speed tamper permits faster laying speeds and reduces maintenance costs; 3) New crawlers feature precision drilled pads and larger pins, offering still further reduction in maintenance costs; 4) A new power unit provides 20 percent more power. This permits pushing bigger trucks and handling steeper grades; and gives a greater reserve of power for high altitude operation, as well as making possible higher operating speeds. Full information on the new Model 879-"B" finisher may be obtained from Barber-Greene Co., 400 N. Highland Ave., Aurora, Ill., or circle **No. 6-6.**

Trucks To Meet Every Need

A sweeping range of model variations and distinctive styling characterize the trucks of the new International A-line. Representative models include the light-duty A-100, A-110, A-120 and A-130, medium-duty A-160 and heavy-duty A-180 series. With gross vehicle weights from 4,200 to 33,000 pounds, these new trucks are available in a broad selection of four and six-wheel and all-wheel-drive models in both conventional and cab-forward design. Power plants for the trucks are five gasoline and four LPG-fueled International Black Diamond valve-in-head, six-cylinder, truck engines ranging from 112 to 154 horsepower. Design features include inside cab dimension of 65 inches and 1,181 square inches of unobstructed visibility through a new sweep-around windshield. For full details write Consumer Relations Dept., International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., or circle **No. 6-9** on the reply card.

Tamper For Earth Compaction

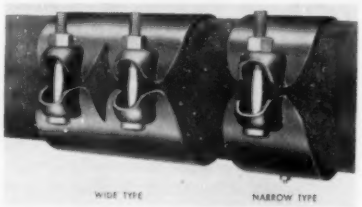
The model Jay 12 tamper, made by the Jay Co., is designed to deliver twenty-two hundred 1800-pound impacts per minute to the material under the tamping shoe. The unit can be easily carried in a light truck or station wagon from one job to another. It is operated and serviced by one man and runs a full eight hours on two gallons of gasoline. It can be used around bridge approaches, sidewalks, close to walls and inside buildings. Tamping shoe sizes are 12, 18 and 24 inches. The shoes can be changed in less than 1 minute to fit any required job or soil condition. The company also has the Model 36, which is particularly designed for larger areas where greater maneuverability of a larger machine is possible. It will develop a 3000-pound blow and delivers the blows at a rate of 2400 per minute. For full details write The Jay Co., 170 Hosack St., Columbus 7, Ohio, or circle **No. 6-7** on the reply card.

Several models of tampers for highway construction are offered by the Jay Co.

New Wheel-Type Parsons Trenchliner

A big capacity Trenchliner, the Parsons 170, has been added to its line of wheel-type trenching machines by The Parsons Co. A new feature on the 170 is a hydraulically driven conveyor that provides belt speeds up to 6000 ft. per minute, yet works completely independent of the wheel speeds. The 170 will produce from 12 ins. to 25 ft. of trench per minute in a range of 30 digging speeds. Maximum digging depth is 5 ft. 9 in. A selection of 7 cutting widths are available, extending from 20 to 32 in., in 2-in. increments. More detailed information from Parsons Co., Newton, Iowa, or circle **No. 6-8** on the reply card.

Newly Designed Pressed Steel Clamp



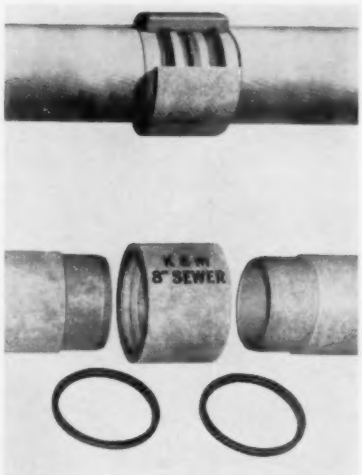
This steel clamp—for repairing rust holes, cracks and corrosion spots in pipe lines—is announced by Skinner. The lugs are not welded to the clamp but formed from the material itself. The narrow width is 4 ins. and the wide width is 8¼ ins. Sizes start at 4 ins. OD and run through all standard steel pipe and also cast iron pipe sizes up to 24 in. OD. For more information write M. B. Skinner Co., South Bend 21, Ind., or circle **No. 6-10** on the reply card.

Rectangular Riveted Aluminum Grating

A new aluminum grating that meets the demands of the construction and maintenance industries for heavy and versatile usage has been announced by Klemp. The RR type aluminum grating was especially designed to retain the combined advantages of a rectangular opening and riveted gratings. This grating remains structurally rigid regardless of cutouts located in any part of the panel. RR grating is easily cleaned and offers greater durability under severe load conditions. There is a 79 percent clear opening with this design, so that the possibility of dirt, oil or scum accumulating in corners is practically nil. Additional details on load data and specifications are available from Klemp Metal Grating Corp., 6608 South Melvina Avenue, Chicago 38, Ill., or by circling **No. 6-11** on the reply card.

Removable Spreader Unit

A new attachment that converts a general truck into an efficient sand, salt, calcium chloride or chip spreader in 15 minutes is introduced by the Fox River Tractor Co. The driver controls the spreading operation with a single lever mounted near the cab of the truck, eliminating the need for two or three-man crews. The unit has a capacity of five cubic yards and the driver can vary the width of the spread from eight to 32 feet, as well as its density; and can spread effectively at speeds of from five to 40 miles an hour. Key to the ease of operation is the patented Fox auger feed. This gives positive flow of materials to the spinner. The spinner is driven by a 2 cylinder Wisconsin air-cooled engine. The spreader is adaptable for street and highway maintenance, street repairs and road building. For more details write Fox River Tractor Co., Appleton, Wisc., or circle **No. 6-12** on the reply card.



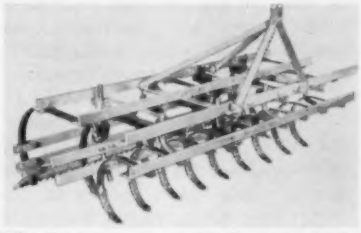
Fluid-Tite coupling makes it impossible for roots to enter at the joints

Asbestos-Cement Sewer Pipe

A specially designed Fluid-Tite coupling for use with 13-ft. lengths of asbestos-cement sewer pipe has been announced by Keasbey & Mattison Co. The sewer pipe is strong, durable, light in weight, and can be easily installed even with unskilled labor, the rapid assembly appreciably reducing installation costs. The Fluid-Tite coupling automatically assures permanent infiltration-proof joints and is quickly assembled without using pullers. The coupling design makes it impossible for roots to enter the joints. Assembly is a simple two-step operation. The rubber rings are lubricated and then the pipe is slid into the coupling. Write for more details to Keasbey & Mattison Co., Ambler, Pa., or circle **No. 6-13** on the reply card.

Roadside and Parkway Seed Bedder

A unique, time saving roadside and parkway seed bedder for attachment to any tractor with rear end lift is announced by Dotmar. The unit scarifies, grades, harrows, cultivates, levels, and rakes. Scarifier blades, cultivator blades and rake are adjustable for any height and the blades also are adjustable horizontally. Wearing parts are of high carbon alloy steel. Full specifications from Dotmar Industries, Inc., 502 Hanselman Bldg., Kalamazoo, Mich., or circle **No. 6-14** on the reply card.



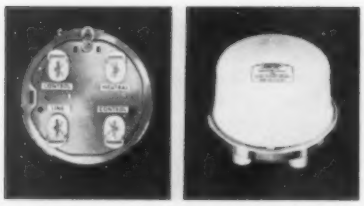
Wheel tractor can pull the seed bedder at normal speeds and in one pass the unit can prepare soil for seeding

Rear-Mounted Street Broom By Shawnee

Designed specifically for the purpose of easy-mounting and dismounting, the Shawnee Mfg. Co. has introduced a rear-mounted street broom. The entire assembly hitches instantly to tractors with three point linkage. Quick couplers on the hydraulic lines further speed the mounting or dismounting. Hydraulic power drives the rotation of the broom through use of a hydraulic motor and the 7-ft. wide broom may be angled 15° to right or left with controls located directly behind the operator. The broom itself is a 30-inch diameter India palm core or steel core. A stabilizing wheel mounted on a swivel at the rear of the broom aids in smooth operation. The broom itself may be tilted by manual adjustments. Additional information from Shawnee Mfg. Co., 1947 North Topeka Avenue, Topeka, Kansas or circle **No. 6-15.**

Demountable spreader unit is used in highway maintenance

Broom is suggested for use on all types of road surfaces



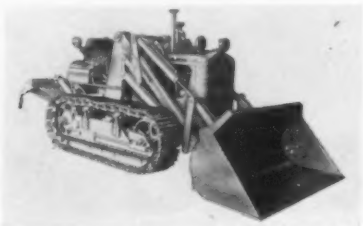
Controls are resistant to discoloration and cracking in severe climates

Multiple Relays For Street Lighting

A series of multiple relays for control of street and highway lighting is available from Micro Balancing, Inc. Models are designed as Lumatrol WM, WMF, WMFB and PM. All feature lifetime mercury to mercury contactors, stainless steel non-breakable contactor housing and reliable operation within a broad range of line voltages. Models WM and WMF will fit all standard watt-hour meter cases, with WMF including a built-in 30-ampere fuse. Model WMFB has the fuse mounted on the back plate, and will fit all meter cases with sufficient fuse clearance. All will provide reliable operation from a line voltage range of 90-130 volts, 60 cycles AC. For further details write Micro Balancing, Inc., Garden City Park, N.Y., or circle **No. 6-16** on the reply card.

OC-126 High-Speed Loader By Oliver

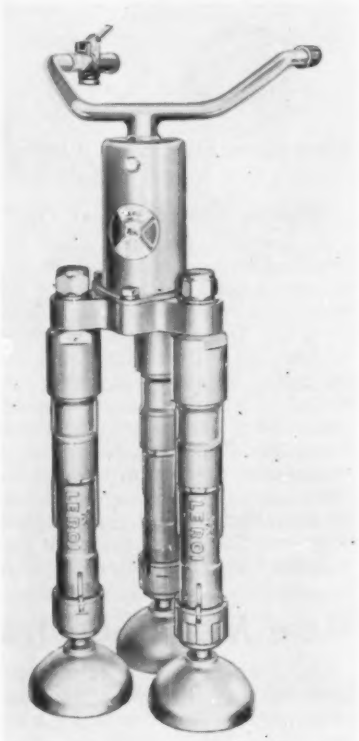
Many major operating improvements are introduced in this new 1½-yd. model, designed specifically as a complete tractor-loader unit. There is low-silhouette mounting with 20 percent lower side pedestals than former models and the low-profile design gives 360-degree clear vision. Low center of gravity results in unusual stability, permitting a quicker, fuller loading cycle. The heavy frame of the OC-126 is rigidly mounted for extra loader strength. Oliver Power-Turn gives the loader two-track power at all times, even on turns. It is powered by a 53-hp diesel or gasoline engine. Complete information from The Oliver Corp., 400 West Madison St., Chicago 6, Ill., or circle **No. 6-17** on the reply card.



New Plastic Pipe

This pipe, made from polyethylene resin, is available in ½ in. through 2-in. sizes and carries the National Sanitation Foundation approval for potable water service. Its flexibility permits easy laying in the field. It comes in coil lengths up to 400 feet. For full details write Orangeburg Mfg. Co., Inc., Orangeburg, N. Y., or circle **No. 6-18** on the reply card.

Triple Tamper Has Built-In Line Oiler and Handle Grip Throttle



Weight of tamper is 114 lbs. and unit is ideal for close foundation tamping

A new triple tamper, with a built-in line oiler to assure positive oil feed while the tamper is in operation, is available from the LeRoi Div. The tamper, the OT11, has a handle grip throttle valve incorporating a safety snap action which shuts off the air supply when the lever is released. Operator safety is increased with the long handle bars, which have comfortable handle grips. The air hose connects to the back of the right handle grip, preventing the air line from interfering with the operator or tamper butts. The weight of the tamper, 114 lbs., is distributed to utilize fully the power stroke of the tampers and to make handling easy. It is ideal for narrow trench, close foundation, or abutment tamping. The three tamper butts cover a 70-square inch area and are mounted on the piston stems by a locking taper of bolted construction. For more information write Le Roi Div., Westinghouse Air Brake Co., Milwaukee 14, Wisc., or circle **No. 6-19** on the reply card.

Half-Ton Capacity Asphalt-Patching Mixer

The new McConnaughay HTD mixer No. 10 is a trailer-type asphalt-patching unit. Designed for use with asphalt cements, cut-backs, emulsions or tars, it features twin pug-mill mixer; positive proportioning with power-driven pump and counter; low-pressure burner shielded from wind and elements; dust-free operation; and replaceable liners. It weighs 5,000 pounds and carries an asphalt tank of 200-gallon capacity; the aggregate bin is of 10 cubic feet capacity marked for volumetric measuring. Complete information from McConnaughay Mixers, Inc., Lafayette, Ind., or circle **No. 6-20** on the reply card.

Trencher For Water Line Construction

A higher utility Ditch-Witch service line trencher for municipalities has been announced by the Charles Machine Works. The new Model M trencher is completely mobile with three forward digging speeds and reverse plus road speeds up to 5 mph. In usual digging conditions the unit will trench at speeds of 1½ to 6 fpm. Trenching widths and depths available on this machine are: 3 ins. wide up to 48 ins. deep, 4 ins. wide up to 36 ins. deep and 6 ins. wide up to 30 ins. deep. The digging chains are quickly interchangeable on the job. Powered by an 8-hp air cooled engine, it is equipped throughout with sealed ball bearings and weighs 500 pounds. For more details write The Charles Machine Works Inc., P. O. Box 628, Perry, Okla., or circle **No. 6-21** on the reply card.

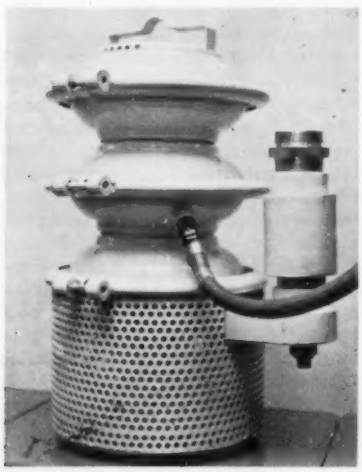
Trencher can be used for digging water service lines and sprinkler lines

Insto-Gas Torches

Insto-Gas is now offering a new Blaze Torch, No. 70, that is light in weight, instant lighting and requires no regulators. The torch can be used for heating asphalt, weed burning and thawing out culverts. The long handle may be removed and the short torch, No. 70-A used to convert oil burning equipment to propane, such as tar kettles and asphalt heaters. For full details write to Insto-Gas Corp., 998 East Woodbridge Ave., Detroit 7, Mich., or circle **No. 6-22** on the reply card.

Diaphragm Type Pneumatic Pump

A new, diaphragm type, pneumatic pump for high head pumping has been announced by the Layton Co. This light and compact pump is an excellent sump-pump for tunnel work to keep headings dry and is readily adaptable to deep shaft work where it will pump with a head of 100 feet or more. The Layton pump can operate also in a shallow trench and is well suited for such operation because of its portability. One man can move it as work progresses without interference with routine duties. It is fire-proof, explosive-proof and leaves no odors, gases or smoke because it operates by air only. The pump ejects fluids with 60 percent solids and highly abrasive liquids. Fluids and materials are bypassed from suction line directly into discharge outlet and do not contact any working parts. It is 22 ins. high, 12 ins. in diameter and weighs 65 pounds. For full information write to The Layton Co., Inc., 4749 S. Whitnall Ave., Cudahy, Wisc., or circle **No. 6-23** on the reply card.



Pump is light and compact and is very quiet, making it fine for indoor work

New Load-Packer Introduced By Gar Wood

Four seconds from the time the cycle begins, the crew can commence loading again

A completely new Load-Packer line has been announced by Gar Wood Industries. The new unit, called the Load-Packer 500, is a batch type unit, with exceptionally fast cycling, a unique loading and compaction action, and a hopper 75 ins. wide with 1½-cu. yd. capacity.

The width permits three men to load side by side; and since the hopper is mounted four inches below the truck chassis, it is easy to load. During tests, crews emptied 50 and 55-gallon drums, standing them vertically on the edge of the hopper's loading sill.

Exceptionally fast cycling is insured for each "batch" of refuse into the body; once the hopper is full, a lever mounted on the side of the body actuates the complete cycle. There is no waiting for the packing plate or hopper to move into position. Four seconds from the time the cycle begins, the hopper is ready to be loaded again—so that crews can work without loading interruptions. During tests, the hopper was emptied faster than two men could load it.

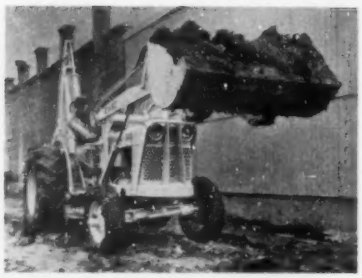
Gar Wood has given the name "cyclomatic loading" to the new unusual loading and packing action. Once the rotary panel reaches the bottom of the hopper, the packing panel moves into position. The full-width packing panel exerts up to 81,000 pounds pressure on the load which it crushes and tightly compacts with a direct thrust at floor level. The panel completes its stroke inside the body, then locks into position to retain the load.

The new 500 unit also features a hopper closure that seals the hopper for travel to and from disposal points. Riding steps are skid proofed for crew safety. Two men can ride on the curb side of the unit. The mechanism operating the loading and compaction action is completely enclosed. There are no exposed drive chains, shafts or flights to endanger operators. A lever mounted within easy reach allows the loading action to be stopped or reversed.

Gar Wood officials state that during recent field trials, on carefully timed routes, pick-ups were increased as much as 25 percent during each shift. Crew members commented that, despite the increased number of pick-ups, they felt fresher, and less fatigued than normally over the same number of hours. For further details write to Gar Wood Industries, Inc., Wayne, Mich., or circle **No. 6-24.**

Hydraulic Backhoe Utility

The Henry Hydraulic Backhoe Super C-10H has been approved for use with the International Harvester 130 tractor. Available with either hydraulic or manual outriggers, the unit makes 9 feet of ground contact. Sixteen bucket sizes are available with the Henry ranging in width from 12 to 38 inches. For further details write to Henry Mfg. Co., Inc., 1700 N. Clay Street, Topeka, Kansas, or circle **No. 6-25** on the reply card.



Backhoe and loader on a Case tractor

Industrial Wheel Tractor

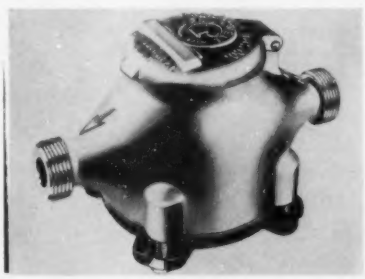
First in a new series of completely equipped wheel tractors, designed and built from the ground up for heavy-duty industrial use, is the new Model 320 introduced by J. I. Case Co. The tractor is powered by a high-torque 148-cu. in. Case industrial engine and has power steering and a new high-speed shuttle transmission. An extra large pump furnishes ample hydraulic power for both tools. The ½-cu. yd. loader bucket features automatic power leveling 26° break-out angle, and 60° grading angle with twin-cylinder hydraulic control. Special backhoe features include exclusive Case foot-controlled 180° swing, 18-ft. 7-in. reach, and 12½-ft. digging depth and telescoping hydraulic stabilizers. Backhoe can be quickly disconnected for using loader alone. For full details write J. I. Case Co., Racine, Wisc., or circle **No. 6-26** on the reply card.

Mobile Pneumatic Masonry Spray Gun

A new mobile pneumatic masonry spray gun especially designed for multiple-purpose, large and small-volume application is now available from Sprayton Equipment Co. The new Model 18 Sprayton gun, which applies up to 3½-cu. yd. per hr., will mix and spray stucco and plaster; apply cement coatings and build concrete walls; grout walls, machine bases or earthworks; and perform wet sandblast operations. It consists of a motor or engine-driven mixing tank and water tank which are assembled on a steel frame that is spring-mounted on four pneumatic-tired wheels. Designed for quick and easy loading, the gun has an integral hopper and screen; a quick-change filler; a patented non-clogging outlet valve; a trigger-operated nozzle and pressurized seals in the mixing tank stuffing boxes. The mixing tank is designed for air pressures up to 200 psi. Capacity of the gun is determined by batch size and batch loading rate. The unit is 54 ins. wide, 145 ins. long and 70 ins. high. Either a 2-hp gasoline engine or a 5-hp electric motor powers the unit. For full data write Sprayton Equipment Co., 18055 James Couzens Highway Detroit 35, Mich., or circle **No. 6-27** on the reply card.

New Sealed Register Water Meter

A new type of water meter, utilizing magnetic force to transmit motion from the measuring chamber to a hermetically sealed register, has been announced by Rockwell Mfg. Co. The entire unit contains 15 stock parts, of which only two moving parts operate in contact with water. Replacing the separate gear train and stuffing box in the new meter are two permanent magnets. One magnet is contained in the oscillating piston in the measuring chamber; the other travels in a well in the sealed register. The force between them effectively transmits motion from measuring chamber to register. Lack of friction permits use of instrument-type gears in the register. Because the small gears use only a small portion of the force supplied by the magnets, the register responds quickly and accurately to piston movement. Purpose of the hermetically sealed register is to eliminate fogging of the register glass, to seal register gearing against dust and atmospheric corrosion, and to remove the gear train from corrosive action of water. The entire sealed register is enclosed within the main casing, eliminating the need for a separate register box and screws. Present registers are straight reading, calibrated in cubic feet or gallons, and use a center sweephand. Future registers will be both straight and circular reading. Meters now in the field are ⅝-in. and ⅝-in. x ¾-in. in size. Future sizes to 1-in. are planned, and the magnetic drive principle will eventually be used in meters larger than 1-in., as well as to other types of meters. For full details write to Rockwell Mfg. Co., 400 No. Lexington Ave., Pittsburgh 8, Pa., or circle **No. 6-28** on the reply card.



Instrument operates on a 2-volt storage battery, is housed in a metal case

Instrument For Measuring Accumulation of Explosive Gases

An improved portable measurement instrument, called the Atlas "Probetector" is now being produced and distributed by Atlas Laboratories. The unit, Model 504, has been designed for use in public utility and general industry where there is a possibility for accumulation of explosive gases. It is factory calibrated for methane and ethane gases, but may be obtained with calibrations for other gases. Actual percentages for specific gases are shown by calibration curves. For further details write to Atlas Laboratories, Inc., Houston, Texas, or circle **No. 6-29.**

Vertical Circulating Pumps

A new line of vertical circulating pumps specially designed for circulating hot or cold water, for booster pump service and in air conditioners is announced by Weil Pump. The pumps, with one shaft seal (mechanical), have features usually found only in horizontally split case design. They are presently available in 2, 3, 4 and 5-in. discharges. Supply and discharge piping are on one side and all operating parts may be removed without disturbing piping connections. The units require only 25 percent floor space of horizontally mounted pumps. For full details write Weil Pump Co., 1530 N. Fremont St., Chicago 22, Ill., or circle **No. 6-30** on the reply card.

Rotary Mower-Shredders

A line of 5-ft. rotary mower-shredders for all mowing and shredding jobs is announced by Wood Brothers. These are equipped with free swinging, heat treated steel blades. Side skids are standard equipment for smooth cutting on rough ground. The cutting height is adjustable from ground level up to 14 inches. The pull-type Model 60 has a 47-in. wheel tread with wheels behind and a 70-in. tread with the wheels at the side. The Model M60 hitch is of three-point design and the tail wheel is Timken bearing equipped and has an 8-in. non-pneumatic tire. For full information write Wood Brothers Mfg. Co., Oregon, Ill., or circle **No. 6-31.**

Self-Propelled Shovel-Crane

A new type of construction tool, fully convertible to shovel, crane, clamshell, drag and hoe, has just been introduced by Thew Shovel. It is Model SP-107, a self-propelled machine mounted on a short-coupled, square (96-in. x 96-in.) rubber-tire carrier with 4-wheel drive. It requires no outriggers to develop a full-rated 7-ton lifting capacity in all positions of turntable swing. A

4-wheel drive is provided along with hydraulic power steering on the wheels on one axle. The power-take-off on the turntable is through an automatic transmission and torque converter. This coupled with the single speed transfer case on the carrier provides 3 travel speeds in both directions up to 15 mph. The independent travel provides for traveling, hoisting, swinging, and boom derricking simultaneously with each under separate clutch control. For further information write The Thew Shovel Co., Lorain, Ohio, or circle **No. 6-32** on the reply card.

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Seismograph to Measure Industrial Vibrations

A seismograph has been purchased by Milwaukee, Wisc., to measure the vibrations resulting from the use of hammers and forges by a downtown machine company.

NEWS OF ENGINEERS

Albert & Knowles, Consulting Engineers of Ann Arbor, Mich., announce that Anthony F. Haven, PE., has opened an office in affiliation with them for the practice of structural engineering. Mr. Haven holds Bachelor and Master degrees from Michigan.

H. W. Hunt has been appointed Executive Editor of Civil Engineering, succeeding Robert K. Lockwood who has been appointed assistant to the Executive Secretary of ASCE. Mr. Hunt, a former associate editor of Engineering News-Record, has had many years of heavy construction experience.

Highway Commissioner of Michigan

John C. Mackie, 36, of Flint, has been elected State Highway Commissioner of Michigan and will assume office July first for a four-year term. Mackie received his civil engineering degree from Michigan State University and did a year of post-graduate work at New York University.

Partners Added to Engineering Firms

George M. Hite, Donald Newton, Carl W. Reh and M. D. R. Riddell have been added as partners to the engineering firm of Greeley & Hansen, 220 S. State St., Chicago 4, Ill. Samuel A. Greeley, Paul E. Langdon, Thomas M. Niles, Kenneth V. Hill and Samuel M. Clarke were already members of the firm.

PROFESSIONAL OPPORTUNITIES

Sanitary Civil or Chemical Engineer Needed

An engineer is needed for environmental sanitation work in Delaware. With headquarters in Dover, work will cover the State and will include review of water and sewerage plans, inspections of systems, supervision of county health unit activities and generally similar problems. A BS degree in sanitary, chemical or civil engineering is required; experience is desirable but not essential; salary depends on training and experience; liberal vacation and sick leave schedules; and a merit system with retirement. Write Don K. Harmeson, Director, Division of Sanitary Engineering, State Board of Health, Dover, Delaware.

Sanitary Sales Engineers Needed

There are openings for sales engineers, especially for men with experience in sewage treatment, with a growing manufacturer in the East. Work consists of assisting Consulting Engineers and present area representatives in proper application of equipment. Salary and working conditions very good. Write Box X-6, Public Works, 200 South Broad St., Ridgewood, N.J.

Trenching Close Behind the Curb

The machine shown in this picture, owned by the American Construction Co., is trenching behind the curb to install drain tile. The location of the trench made it difficult for a machine to straddle the trench. This unit, with an offset boom extension and 15-in. trenching bucket reached out to trench behind the curb. Each 114-ft. section of this trench 15 ins. wide and 32 ins. deep was excavated to grade in 1½ hours. Other jobs performed on this project by this equipment including grading, sloping, structure excavating, digging out driveways and crane work. There are four Gradall models: standard carrier, crawler-mounted, self-propelled and the railroad Gradall. The units are made by Warner & Swasey of Cleveland, Ohio.

COST OF WATER FILTRATION

In the El Centro Water Plant article (PUBLIC WORKS for May, 1957) it was inadvertently stated that the filter plant cost was $50,000 per MGD. Our breakdown costs, using the actual contract prices, show that the net filter plant cost amounted to $653,935. This figure includes the complete filtration plant, clarifier, chemical treatment, building, parking area, and also includes all treated water pumping, including the high service pump station. Based on the nominal plant capacity of 16.5 MGD, which is about 15 percent less than actual plant capacity, this will amount to $39,632 per MGD of filter plant capacity.

Unusually low cost of this plant is one of its principal features; therefore we would like to have this correction noted.

Joseph F. Golden
Golden, Bryant & Jehle
Architects and Engineers
El Centro, California

• • •

Montana Section, AWWA, Stresses Water Conservation

At the 32nd annual meeting of the Montana Section, AWWA, held in Great Falls, the following officers were elected: Chairman, R. G. Cronin of Missoula; Vice-Chairman, Carl King, Chinook; National Director, Dave S. Thomas, Great Falls; Trustees, C. W. Brinck, Helena, and Ed Waldo, Billings; and Secretary-Treasurer, A. W. Clarkson, Helena. The meeting opened with a symposium on stream pollution prevention by industries. Speakers included Joseph Rempe of Waldorf Paper Co., R. L. Kimmons of the Great Western Sugar Co., C. A. Cromwell who spoke on oil processing wastes, and John Hazen who discussed the mining industry problems. In addition to other excellent technical papers, Paul Weir of the AWWA and Emil Jensen of FSIWA spoke on Association matters.

CLASSIFIED ADVERTISING AND JOB OPPORTUNITIES

ASSISTANT CIVIL ENGINEER

To meet requirements of an expanding program two immediate appointments will be made to permanent positions. Applicant should have B.S.C.E. or equivalent experience; plus two years responsible experience in civil engineering. Very congenial working conditions. $532 to start. For information, write:

San Diego County Civil Service
403 Civic Center
San Diego 1, California

SUPERINTENDENT OF PUBLIC WORKS

The City of Keene, New Hampshire is seeking applications for the position of Superintendent of Public Works. Will have charge of the sewer and water division, highway and drain division, equipment, and office staff. Qualifications preferred are: supervisory experience in public or private construction work; an engineering degree or experience is not required as the City has a City Engineering Department fully staffed at the present time. This progressive City of 17,000 population is located in the heart of picturesque New England. Salary is $7,000 per year maximum. *Write for applications to:*

Mr. Donald E. Chick
City Manager
City Hall
Keene, New Hampshire

City of Dallas Needs
Plant Maintenance Supervisor

Degree in electrical or mechanical engineering or equivalent. Five years responsible experience in large public or private water system. Salary range $469 to $622 per month. Apply or write to:

Civil Service Board, Room 401
Municipal Building, 2014 Main
Dallas 1, Texas

CIVIL ENGINEER

A Civil Engineer is wanted for Public Works Department of a New Jersey municipality for surveys and construction, field and office. State education, experience and salary requirements.

Write to:
Box 6-1
Care of Public Works Magazine

SAN FRANCISCO CITY AND COUNTY IMMEDIATE EMPLOYMENT POSSIBILITIES

VARIETY OF PUBLIC WORKS PROGRAMS

Junior Engineer (Civil, Mechanical, Electrical) ..... $480—$550
Assistant Engineer I (Civil, Mechanical, Electrical) .. $525—$630
Assistant Engineer II (Mechanical) ..... $625—$715

For Further Information and Applications, inquire:

San Francisco Civil Service Commission
154 City Hall
San Francisco, California

ADMINISTRATIVE ENGINEER AVAILABLE

Graduate civil engineer, 36, with training in Public Relations and Supervision and experienced in technical-supervisory administrative positions in building construction and city government (presently major city Chief Building Inspector) desires position in Florida or other South Coast area.

Write to:
Box 6-2
Care of Public Works Magazine

ENGINEER WANTED

The City of Borger, Texas needs an engineer to serve as Traffic Engineer, and Director of the Street Construction, Street Maintenance and Refuse Collection Departments. Traffic Engineering experience is not required, but would be valuable. Salary open. Direct applications to:

Mr. A. C. Spears
City Manager
City Hall, Borger, Texas

VALUABLE INFORMATION FOR ENGINEERS

Thousands of progressive engineers are finding that our readers' service section is the easy, handy way to obtain new catalogs of advertised products. Be sure and return the postage free reply card opposite page 78.

SEE PAGES 34 to 64

INDEX OF ADVERTISEMENTS

CONSULTING ENGINEERS APPEAR ON PAGES 202 to 206

PUBLIC WORKS JOURNAL CORP.

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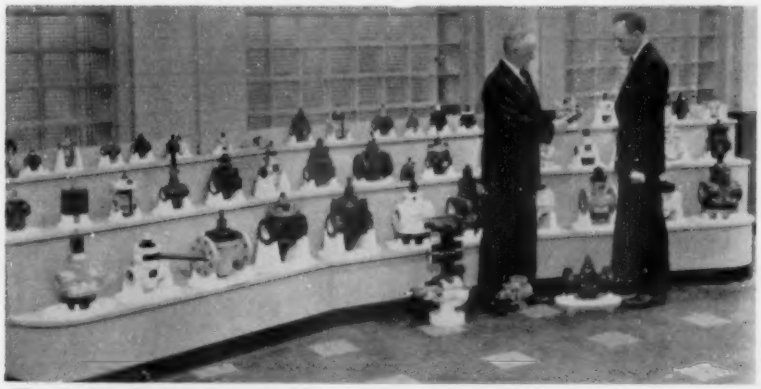
Worth Seeing



The Rockwell Manufacturing Company's valve museum portraying lubricated plug valve development has been opened at their Barberton, Ohio, plant. Included are valves of other manufacturers to reflect the influence of the original designs.

Big deal in big pipe! 48" Cen-Vi-Ro drainage pipe on a state highway job near Fort Walton in western Florida.

You may never need to park an elephant, but if you ever do, Sarasota, Fla., shows you how! This stunt publicized opening of that progressive city's first municipally owned parking lot to relieve in-town traffic congestion. Elephant by Ringling.

Blaw-Knox standard steel street forms being used to form the piles designed to support a quay wall at the Charleston, S. C. Minecraft Base. This is believed to be first use of such forms in this application.

Beautiful but not dumb secretary Ruth Booten hitchhikes on the first J. I. Case Co. TerraTrac crawler unit made at Burlington, Iowa, plant.

by Arthur K. Akers

★ 100 YEARS is a long time in any man's book, but Graver Tank and Mfg. Co., East Chicago, Ind., has just celebrated that anniversary. Prizes are being offered by them for pictures and data on the oldest Graver tank or other product, also for ideas on decoration of tank facilities.

★ HERSEY MFG. CO. (water meters), of Boston, elects William B. Cambridge vice-president, sales. He has long been a familiar figure in the water works field.

Mr. Wigle

Mr. Cambridge

★ SHERMAN PRODUCTS, Inc., Royal Oak, Mich., appoints William W. Wigle as assistant to Robert W. Humes, sales manager, Sherman Division.

★ LATEST expansion of The Foxboro Company, instrument manufacturers, will be an addition to their plant at Foxboro, Mass. This is their sixth increase in manufacturing facilities in just three years.

★ THIS COLUMN is not always light-hearted: we chronicle with regret the untimely passing of another old friend, J. A. ("Dick") Thomas, vice-president and general manager of Roberts Filter Mfg. Co., Darby, Pa. Charles ("Chick") Roberts assumes his responsibilities pending further announcement.

★ CARL R. ROWE, Jr. is promoted to national sales director of Rowco Mfg. Co., Keene, N.H., makers *par excellence* of brush cutters for the roadsides of America.

Mr. Engel

Mr. Gustafson

★ INFILCO INC., Tucson, Arizona, announces the first change in its presidency in many years. President P. N. Engel, who started with Infilco in 1902, now becomes chairman of its board. J. S. Gustafson, who has held various offices with the company since 1951, succeeds Mr. Engel in the presidency.

★ NORMAN R. GAHNZ, sales manager since 1925 of the Road Machinery Division, Wausau Iron Works, now heads an expanded sales organization including the steel and fabricating divisions.

★ DAN R. GANNON is now field sales manager, Mueller Company, valves and hydrants, Decatur, Ill.

★ W. M. DREIER, formerly sales vice-president, Massey-Harris-Ferguson, Ltd., has joined J. I. Case Co., Racine, Wis., as a sales executive. J. N. Bayley has been advanced to Atlanta branch manager for Case.

★ DON S. PERMAR is named assistant general sales manager, Le Roi Division, Westinghouse Air Brake Co., Milwaukee, a newly-created position necessitated by increased sales.

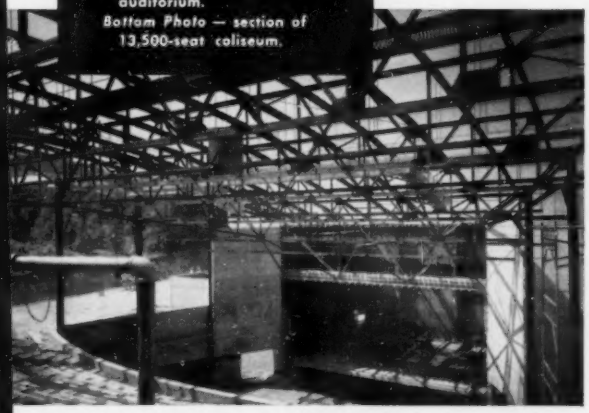
★ BROS INCORPORATED is the new name of William Bros Boiler & Mfg. Co.

★ LAWYER: "But if a man is kneeling down in the middle of the road that doesn't prove that he is intoxicated."

ARRESTING OFFICER: "No, sir, but this man was trying to roll up the center strip."

Municipal Auditorium and Coliseum, Charlotte, N. C.
Archt. — A. G. O'Dell, Jr. & Associates, Charlotte, N. C.
Struct. Engr. — Severud, Elstad, Krueger, New York, N. Y.
Contr. — Thompson & Street Co., Charlotte, N. C.
Pozzolith ready-mixed concrete — Concrete Supply Co., Charlotte, N. C.
Below — view of 2500-seat auditorium.
Bottom Photo — section of 13,500-seat coliseum.

Concrete of good appearance and other desired qualities with POZZOLITH*



In the construction of this outstanding municipal auditorium and coliseum — as with many other important projects built since 1932 — Pozzolith proved a valuable aid in improving cohesiveness and plasticity, to enhance the appearance of exposed concrete.

Beauty and utility with architectural concrete is but one of the advantages obtained with Pozzolith . . . key to the control of:

1. water content . . . makes possible lowest water content for a given workability.

2. entrained air . . . provides optimum air content without sacrificing other desired qualities.

3. rate of hardening . . . provides desired handling and finishing time under widely varying job conditions.

Any one of our more than 100 seasoned fieldmen will be glad to demonstrate the full benefits of Pozzolith for *your* project, and to advise of the availability of Pozzolith Ready Mixed Concrete through more than 1000 qualified producers.

* POZZOLITH . . . compounded from exclusive technical components including Master Builders time-tested cement-dispersing agent, modifies the kinetics of the portland cement hydration process thereby improving the quality of concrete and its control.

THE MASTER BUILDERS CO.

Division of American-Marietta Company

Cleveland 3, Ohio—Toronto 9, Ontario

Cable Address, Mastmethod, N Y.

NOW...Dosage Automation

with the

W&T *Quality-Quantity Chlorinator*

Select the residual you want and the new W&T Quality-Quantity Chlorinator will automatically maintain that residual. Immediate sensing of any change in a water's chlorine demand—as well as flow—automatically controls chlorine feed rate to maintain a desired residual. That is Dosage Automation with the new W&T Quality-Quantity V-notch Chlorinator.

DOSAGE AUTOMATION OFFERS THESE FEATURES:

Maintains

a selected residual, free or total, with automatic dosage control.

Anticipates

changes in chlorine demand.

Controls

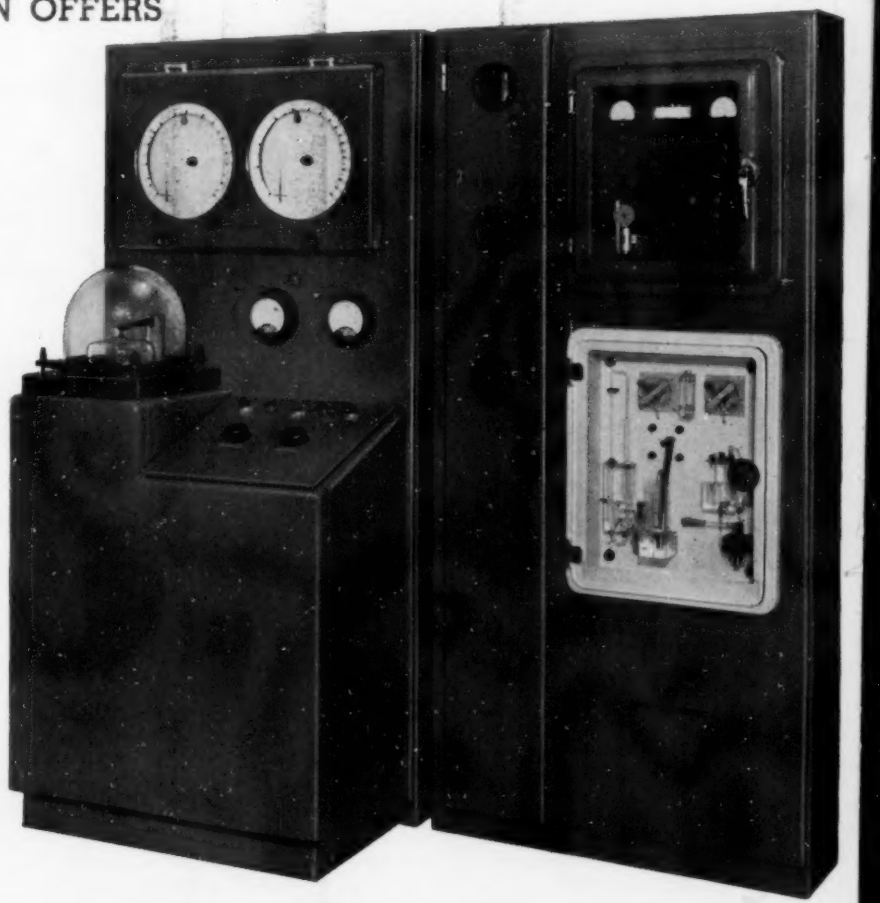
Chlorine feed up to a full 100 to 1 range at rates to 2000 pounds of chlorine per 24 hours.

Provides

a record of chlorine dosages in p.p.m. and chlorine feed rates in pounds per 24 hours.

Utilizes

the proven W&T V-notch Variable-Orifice for accurate, wide range chlorine feed.



For more information about this new type of chlorination system write for Bulletin S-116.

WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY